

**DEPARTMENT OF VETERANS AFFAIRS  
 VHA MASTER SPECIFICATIONS**

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**SECTION 01 00 00**  
**GENERAL REQUIREMENTS**

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**SECTION 01 00 00**  
**GENERAL REQUIREMENTS**

**1.0 SYNONYMOUS TERMS**

- A. Wherever the terms COR, Resident Engineer, (RE), Contracting Officers technical Representative, or COTR, are used, in these specifications, they shall be taken to be synonymous with the term "Contracting Officers Representative".

**1.1 SAFETY REQUIREMENTS**

Refer to section 01 35 26, SAFETY REQUIREMENTS for safety and infection control requirements.

**1.2 GENERAL INTENTION**

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing items, and furnish labor and materials and perform work for Replace Mechanical Controls Upgrade Cabs Main Elevators Project No 657-15-200JC VA Health Care System St Louis, John Cochran Division as required by specifications and drawings.
- B. Visits to the site by bidders may be made only during one organized pre-proposal site visit.
- C. Offices of Mechanical Consultants Inc. as Engineers of Record will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or their duly authorized representative.
- D. Not Used
- E. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA Police, be identified by project and employer, and restricted from unauthorized access.

**1.3 STATEMENT OF BID ITEM(S)**

- A. BID ITEM #1: Work to include general construction, mechanical and electrical work, to completely Upgrade Cabs, Replace Mechanical Controls, and Main Elevators in Building 1 as shown on the specifications and drawings for Project 657-15-200JC. **Work will be completed IAW General Requirements Section 1.6 OPERATIONS AND STORAGE AREAS Para G. Phasing Schedule.** ELEVATOR GUARANTEED PERIOD SERVICES IS PRICED SEPARATELY IN BID ITEM 2) (SEE SPECIFICATION SECTION 14 99 00). POP is 480 days after NTP.



B. **BID ITEM #2:** GUARANTEE PERIOD SERVICES)IAW Spec Section 14 99 00,

Maintenance Services for ten (10) Elevators, two each (2) cart lifts and dumbwaiter one each (1) for \$ \_\_\_\_\_ Per Month for POP 480 days after NTP and cover the additional one year warranty period. Per Month for POP 480 days after NTP and cover the additional one year warranty period.

C. **BID ITEM #3** (Deduct #1) All work in Bid item #1, minus all work associated with Upgrading and maintenance the PHARMACY DUMBWAITER. (SEE SPECIFICATION SECTION 14 99 00). POP is 480 days after NTP.

D. **BID ITEM #4:** (Deduct #2) All work in Bid Item #3, minus all work associated with Upgrading and maintenance for ELEVATOR #10. (SEE SPECIFICATION SECTION 14 99 00). POP is 480 days after NTP.

E. **BID ITEM #5:** (Deduct #3) All work in Bid Item #4 minus all work associated with upgrading and maintenance for the CLEAN AND SOILED CART LIFTS. (SEE SPECIFICATION SECTION 14 99 00). POP is 480 days after NTP.

**Regardless of which bid item is awarded (i.e., 1, 3, 4 or 5) GUARANTEE PERIOD SERVICES, bid item #2, will also be awarded. Offerors shall submit pricing on all bid items.**

#### 1.4 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- A. Drawings and contract documents may be obtained from the website where the solicitation is posted. Additional copies will be at Contractor's expense.
- B. After award of contract, no hard copy sets of specifications and drawings will be furnished.

#### 1.5 CONSTRUCTION SECURITY REQUIREMENTS

A. Security Plan:

- 1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
- 2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.

B. Security Procedures:

- 1. General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
  - a. Except for initiating registration with the PIV sponsor, personnel conducting business pursuant to this contract shall not enter VA owned or leased property without a current and valid VA issued badge. Personnel may also be subject to inspection of their personal effects, including tool boxes; lockers, vehicle, or any other container, while on VA owned or leased property upon request from VA Police.
  - b. To be processed for a VA ID Badge, contact the VA-St L HCS-JC Engineering Service PIV sponsor to arrange for an appointment and to receive information on the required documentation. The appropriate contact information will be issued during the Pre-Construction meeting with the Contracting Officer and the Contracting Officer Representative (COR).
  - c. Flash Badge: Common physical access and no biometric information required.

d. The level of badging and its corresponding duration of investigation are directly dependent on the level of security access required to perform contract tasks.

2. Before starting work the General Contractor shall give three weeks' notice to the Contracting Officer so that security arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section. Normal working hours are Monday through Friday, 7:30 a.m. through 4:00 p.m., except during Federal Holidays. For working outside the normal working hours, a request must be submitted at least twenty-one (21) days in advance of the requested work date and in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
3. No photography of VA premises is allowed without written permission of the Contracting Officer.
4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

C. Guards: Not Used

D. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the Contracting officers representative (COR) for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action.
2. For any door controlling entrance to the construction area(s), the VA will supply to the contractor a door lock and its corresponding key. The General Contractor will be responsible for ensuring the construction site remains under lock and key to prevent the general population from entering the construction area. Upon project completion, the General Contractor must return the lock and key to the Contracting Officer Representative.

E. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information".
2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
3. Certain documents, sketches, videos or photographs and drawings may be marked "Law Enforcement Sensitive" or "Sensitive Unclassified". Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the Contracting Officer upon request.

4. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
5. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
6. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of "sensitive information".
7. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
  - a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.
  - b. "Sensitive information" including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

F. Motor Vehicle Restrictions

1. There is no contractor parking on hospital property at John Cochran (JC) Division bounded by Grand, Enright, Spring and Bell Avenues. Contractor parking is permitted in Parking Lot K (VA lot across Grand Avenue from the medical center) in designated marked spaces. Contractor may load and unload materials in unrestricted areas only. Access to the Building 1 loading dock shall be restricted to picking up and dropping off materials and supplies, and no such activity may leave a vehicle unattended.
2. Roll Listing: Before work begins, the General Contractor must submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES, a roll listing all personnel, including administrators and subcontractors, conducting business pursuant to this contract. The roll must show, at a minimum, the following:
  - a. Contractor Tier (General, Subcontractor Tier I, Subcontractor Tier II, etc.)
  - b. Contractor's company name
  - c. Contractor's legal last name
  - d. Contractor's legal first name
  - e. Contractor's trade (corresponding to trade listed in General Conditions for Labor Wage Determination) or position (if administrator or managerial)
  - f. Infection Prevention training certification date
  - g. Infection Prevention training certification submittal date
  - h. Contractor's Safety Briefing date
  - i. Contractor's Safety Briefing submittal date
  - j. OSHA Construction Safety certification level (10-hour, 30-hour)
  - k. OSHA Construction Safety certification number
  - l. OSHA Construction Safety certification submittal date
  - m. Designation as OSHA Competent Person (CP)
  - n. Designation as OSHA Competent Person (CP) submittal date
  - o. Personal Identification Verification (PIV) badge issuance date
  - p. Designated as person requiring issuance of a VA key for work site entry.

## 1.6 OPERATIONS AND STORAGE AREAS

A. The Contractor shall confine all construction operations on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

B. NOT USED / NOT APPLICABLE

C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

(FAR 52.236-10)

D. Working space and space available for storing materials is extremely limited and any additional space granted shall be determined by the COR.

E. Workmen are subject to rules of Medical Center applicable to their conduct. Execute work in such a manner as to interfere as little as possible with work being done by others. Keep roads clear of construction materials, debris, standing construction equipment and vehicles at all times.

F. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COR where required by limited working space.

1. Do not store materials and equipment in other than assigned areas.
2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to Medical Center areas required to remain in operation.
3. Where access by Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.
4. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR. All such actions shall be coordinated with the COR or Utility Company involved.
5. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the

responsibility of the Contractor.

G. Phasing:

- a. The Medical Center must maintain its operation 24 hours a day 7 days a week. Therefore, any interruption in service must be scheduled and coordinated with the COR to ensure that no lapses in operation occur. It is the CONTRACTOR'S responsibility to develop a work plan and schedule detailing, at a minimum, the procedures to be employed, the equipment and materials to be used, the interim life safety measure to be used during the work, and a schedule defining the duration of the work with milestone subtasks. The work to be outlined shall include, but not be limited to:
  1. In order to limit interference with the owners' use of the building, work of this contract shall be staged by the contractor to comply with the following guidelines:
    - (a) ONLY (1) ELEVATOR IN A GROUP MAY BE OUT OF SERVICE AT A TIME.
      1. THE ELEVATOR GROUPS ARE AS FOLLOWS:
        - a. Group A1 /Bank A, Elevator Cars 1, 2, 3, & 4.
        - b. Group A2 /Bank A, Elevators: 5 & 6.
        - c. Group B /Bank B, Elevators: 7, 8, & 9.
        - d. Group C /Building 1 Elevator Car: 10.
        - e. Group D /Building 1 Clean and Soiled Cart Lifts.
        - f. Building 1 Pharmacy Dumbwaiter
      2. Once an elevator car is taken out of service, all specified upgrades to that elevator car, including revisions to all of its associated lobby doors, shall be completed within 120 calendar days.
      3. Elevator Bank B, car 7 shall not be taken out of service until the upgrades to elevators 5 & 6 are completed.
      4. Once a cart lift is taken out of service, all specified upgrades shall be completed and the cart lift returned to service within 45 days.
      5. The pharmacy lift shall not be taken out of service while elevator Bank B, car 7 is out of service.
      6. The clean cart lift and soiled cart lift may not be taken out of service at the same time.
      7. To insure such executions, Contractor shall furnish the COR with a schedule of approximate phasing dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the COR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof.

H. Building areas to be vacated will include:

- a. The 8th floor bank B lobby area will be vacated until all work on the "b" bank elevators is completed. All other lobby areas will remain in use except in the immediate area of the work. Access to, and use of, operable elevator cars and controls shall not be obstructed while work is being performed on adjacent cars. Immediate areas of alterations not mentioned in preceding Subparagraph 1 will be temporarily vacated only while alterations are performed.
- b. Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. Contractor shall permit access to Department of Veterans Affairs personnel and patients through other construction areas which serve as routes of access to such affected areas and equipment.

I. NOT USED / NOT APPLICABLE

J. When a building and / or site is turned over to Contractor, contractor shall accept responsibility including upkeep and maintenance.

- a. Contractor shall maintain a minimum temperature of 4 degrees C (40 degrees F) all times, except as otherwise specified.
- b. Contractor shall maintain in operating condition existing fire protection and alarm equipment. In connection with fire alarm equipment, Contractor shall make arrangements for pre inspection of site with Fire Department or Company (Department of Veterans Affairs or municipal) whichever will be required to respond to an alarm from Contractor's employee or watchman.

K. Utilities Services:

- a. Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by the COR.
- b. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of the COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without a detailed work plan, the Medical Center Director's prior knowledge and written approval. Refer to specification Sections: 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY for additional requirements.

- c. Contractor shall submit a request to interrupt any such services to the COR, in writing, 21 days in advance of proposed interruption to the Facilities Engineering Director after approval by the Contracting Officer Representative. Request shall state reason, date, exact time of, and approximate duration of such interruption.
  - d. Contractor will be advised (in writing) of approval of request, or of other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
  - e. Major interruptions of any system must be requested, in writing, at least 21 calendar days prior to the desired time and shall be performed as directed by the COR.
  - f. In case of a contract construction emergency, service will be interrupted on approval of the COR. Such approval will be confirmed in writing as soon as practical.
  - g. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Contractor.
- L. Abandoned Lines:
- a. All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged at the main, branch or panel they originate from. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.
- M. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
- a. Keep corridors, walkways and entrance to project area clear of construction materials, debris and standing construction equipment and vehicles.
  - b. Method and scheduling of required cutting, altering and removal of existing roads; walks and entrances must be approved by the COR.
- N. Coordination:
- 1. Coordinate the work for this contract with respect elevator construction operations with in-house shop foremen as directed by COR. This includes the scheduling of preliminary inspections and above ceiling and in wall inspections. All removal and relocation of items listed must be coordinated with the in house shops and COR.

- a. Remove, relocate, and extend existing installations to accommodate new construction in accordance with in house shops.
- b. Remove abandoned wiring to source of supply unless otherwise indicated on the drawings as approved by the COR.
- c. All abandoned or unused existing telecom, communications and IT wiring shall be removed to source at respective termination centers. This will be coordinated with Facility IT department.
- d. Remove exposed abandoned conduit. Cut conduit flush with walls and floors, and patch surfaces to the approval of COR.
- e. Verify with VA before disconnecting abandoned outlets and removing devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank covers as needed.
- f. Disconnect and remove electrical devices and equipment serving elevator utilization equipment that has been removed.
- g. Disconnect and remove luminaires as indicated. Remove brackets, stems, hangers, and other accessories. Protect luminaires to be re-installed. Replace any luminaires damaged during demolition or installation Coordinated with electrical shops.
- h. Disconnect and remove existing connections to related mechanical equipment to be removed.
- i. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate with approval of COR and electrical shop.
- j. When a piece of equipment is scheduled for removal, all wire and exposed conduit shall be removed in coordination with COR.
- k. General contractor shall coordinate 'In-Wall' & 'Overhead Ceiling' Inspections with the VA COR prior to the installation of finishes. In- Wall inspections require 24 hour notification to COR. Overhead Ceiling inspections require 48 hour notification to COR. Contractor to supply a cart with a log sheet and full set of half size hard copy drawings for all inspections. Log sheet shall be itemized by type of inspection and by room. No such finishes shall be installed without inspection approval from the COR.

- O. Coordination with Cemetery  
NOT USED / NOT APPLICABLE

## 1.7 ALTERATIONS

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR of areas of building in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, to the Contracting Officer. This report shall list by rooms and spaces.
1. Existing condition and types of resilient flooring, doors, windows, walls and other surfaces not required to be altered throughout work zone affected areas of building.
  2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, shades, etc., required by drawings to be either reused or relocated, or both.



3. Shall note any discrepancies between drawings and existing conditions at site.
  4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and COR.
- B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COR to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4 and VAAR 852.236-88).
- C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and COR together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls and other surfaces as compared with conditions of same as noted in first condition survey report:
1. Re-survey report shall also list any damage caused by Contractor to such flooring and other surfaces, despite protection measures; and, will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workmen in executing work of this contract.
- D. Protection: Provide the following protective measures:
1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.
  2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.
  3. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

### **1.8 Disposal and Retention**

- A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:
1. Reserved items which are to remain property of the Government are identified by attached tags or noted on drawings or in specifications as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which

would be detrimental to re-installation and reuse. Store such items where directed by COR.

2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.
3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.
4. NOT USED / NOT APPLICABLE

#### **1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS**

- A. The Contractor shall preserve and protect all structures and equipment, on adjacent to the work site, which is not to be removed and which does not unreasonably interfere with the work required under this contract. The Contractor shall only remove items when specifically authorized to do so, and shall avoid damaging anything that will remain in place. If any damage occurs by the careless operation of equipment, or by workmen, the Contractor shall repair or replace those items as directed by the Contracting Officer.
- B. The Contractor shall protect from damage all existing improvements and Utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.
- C. NOT USED
- D. NOT USED

#### **1.10 RESTORATION**

- A. Remove, cut, alters, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COR . Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new

work, and refinished and left in as good condition as existed before commencing work.

- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

#### **1.11 PHYSICAL DATA**

- A. Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.
  - 1. The indications of physical conditions on the drawings and in the specification are the results of site investigations by A/E.  
(FAR 52.236-4)
- B. NOT USED / NOT APPLICABLE
- C. NOT USED / NOT APPLICABLE.
- D. Government does not guarantee that other materials will not be encountered north that proportions, conditions or character of several materials will not vary from those indicated by explorations. Bidders are expected to examine site of work, and, after investigation, decide for themselves character of materials and make their bids accordingly.

#### **1.12 PROFESSIONAL SURVEYING SERVICES:**

**NOT USED / NOT APPLICABLE**

#### **1.13 LAYOUT OF WORK:**

- A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines that may be established or indicated by the Contracting Officer.

**(FAR 52.236-17)**

#### **1.14 AS-BUILT DRAWINGS**

- A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all changes, modifications and clarifications.

- B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the COR review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings in the Electronic version (scanned PDF) to the COR within 15 calendar days after each completed phase and after the acceptance of the project by the COR.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

#### **1.15 USE OF ROADWAYS**

- A. NOT USED

#### **1.16 RESIDENT ENGINEER'S FIELD OFFICE**

- A. NOT USE

#### **1.17 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT**

- A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to written approval and compliance with the following provisions:
  - 1. Permission to use each unit or system must be given by COR in writing. If the equipment is not installed and maintained in accordance with the written agreement and following provisions, the COR will withdraw permission for use of the equipment.
  - 2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Installation of temporary electrical equipment or devices shall be in accordance with NFPA 70, National Electrical Code, (2014 Edition), Article 590, *Temporary Installations*. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
  - 3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
  - 4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
  - 5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
  - 6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in

temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government. Boilers, pumps, feed water heaters and auxiliary equipment must be operated as a complete system and be fully maintained by operating personnel. Boiler water must be given complete and continuous chemical treatment.

- B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.
- C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.
- D. Any damage to the equipment or excessive wear due to prolonged use will be repaired replaced by the contractor at the contractor's expense.

#### **1.18 TEMPORARY USE OF EXISTING ELEVATORS**

- A. Contractor will be allowed use of existing elevators for handling building materials and Contractor's personnel this will be permitted subject to following provisions:
  - 1. Contractor makes all arrangements with the COR for use of elevators. Contractor may use not have exclusive use of elevators at any time.
  - 2. Contractor covers and provides maximum protection of following elevator components:
    - a. Entrance jambs, heads and threshold plates.
    - b. Entrance columns, canopy, return panels and inside surface walls.
    - c. Finished flooring.
  - 3. All items transported in the elevators shall meet the requirements of section 1.8 Infection Prevention Measures in this specification.
  - 4. Contractor shall operate elevators within load conditions of the elevator manufacturer.
  - 5. Place elevator in condition equal, less normal wear, to that existing at time it was placed in service of Contractor as approved by Contracting Officer.

#### **1.19 TEMPORARY USE OF NEW ELEVATORS**

- A. The Contractor and his personnel shall be permitted use of new elevator(s) subject to the following provisions:
  - 1. Contractor shall make arrangements with the COR for use of elevator(s). Contractor may not obtain elevator(s) for exclusive use.
  - 2. Prior to the use of elevator(s), the Contractor shall have the elevator(s) inspected and accepted by an ASME accredited, certified elevator safety inspector. The acceptance report shall be submitted to the COR.

3. Submit to the COR the schedule and procedures for maintaining equipment. Indicate the day or days of the week and total hours required for maintenance. A report shall be submitted to the COR monthly indicating the type of maintenance conducted, hours used, and any repairs made to the elevator(s).
4. The Contractor shall be responsible for enforcing the maintenance procedures as per VA and manufacturers recommendations and requirements.
5. During temporary use of elevator(s) all repairs, equipment replacement and cost of maintenance shall be the responsibility of the Contractor.
6. Personnel for operating elevator(s) shall not be provided by the Department of Veterans Affairs.
7. Contractor shall cover and provide maximum protection of the entire elevator(s) installation.
8. The Contractor shall arrange for the elevator company to perform operation of the elevator(s) so that an ASME accredited, certified elevator safety inspector can evaluate the equipment. The Contractor shall be responsible for any repair costs of the elevator company.
9. All elevator(s) parts worn or damaged during temporary use shall be removed and replaced with new parts at the contractors' expense. This shall be determined by an ASME accredited certified elevator safety inspector after temporary use and before acceptance by the Government. Submit report to the COR for approval.
10. Elevator shall be tested as required by the testing section of the elevator(s) specifications before acceptance by the Department of Veterans Affairs. The Contractor shall be responsible for all cost associated with testing and inspection.

#### **1.20 TEMPORARY TOILETS**

- A. Contractors are permitted to use toilets in Building 1, Level 03 only.

#### **1.21 AVAILABILITY AND USE OF UTILITY SERVICES**

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at Contractor's expense and in a workmanlike manner, in compliance with code and as satisfactory to the Contracting Officer Representative, shall install and maintain all necessary temporary connections and distribution lines. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters and associated paraphernalia. And repairs restore the infrastructure as required.
- C. NOT USED / NOT APPLICABLE
- D. Heat: Furnish temporary heat necessary to prevent injury to work and materials

through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials

1. Contractor may not obtain heat by connecting to Medical Center heating distribution system.

E. Electricity (for Construction and Testing): V. A. will furnish

1. Obtain electricity by connecting to the Medical Center electrical distribution system. Electricity is available at no cost to the Contractor. Request access at least twenty-one (21) days in advance, and in accordance with, Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

F. Water (for Construction and Testing): V. A. Furnish temporary water service.

1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection as per code. Water is available at no cost to the Contractor.
2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at Contractor's discretion) of use of water from Medical Center's system.

G. Fuel: NOT USED / NOT APPLICABLE

## **1.22 NEW TELEPHONE EQUIPMENT**

A. NOT USED / NOT APPLICABLE

## **1.23 TESTS**

- A. AS PER SPECIFICATION SECTION 23 05 93 TESTING, ADJUSTING, AND BALANCING. THE CONTRACTOR SHALL PROVIDE A WRITTEN TESTING AND COMMISSIONING PLAN COMPLETE WITH COMPONENT LEVEL, EQUIPMENT LEVEL, SUB-SYSTEM LEVEL AND SYSTEM LEVEL BREAKDOWNS. THE PLAN WILL PROVIDE A SCHEDULE AND A WRITTEN SEQUENCE OF WHAT WILL BE TESTED, HOW AND WHAT THE EXPECTED OUTCOME WILL BE. THIS DOCUMENT WILL BE SUBMITTED FOR APPROVAL PRIOR TO COMMENCING WORK. THE CONTRACTOR SHALL DOCUMENT THE RESULTS OF THE APPROVED PLAN AND SUBMIT FOR APPROVAL WITH THE AS BUILT DOCUMENTATION.
- B. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- C. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.
- D. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire system which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one part of entire system which provides comfort conditions for a

building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc. Another example of a system which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feed water, condensate and other related components.

- E. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably period of time during which operating and environmental conditions remain reasonably constant and are typical of the design conditions.
- F. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

#### **1.24 INSTRUCTIONS**

- A. Contractor shall furnish Maintenance and Operating manuals (hard copies and electronic) and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals and one compact disc (four hard copies and one electronic copy each) for each separate piece of equipment shall be delivered to the COR coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.
- C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed training to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such



times as scheduled by the COR and shall be considered concluded only when the COR is satisfied in regard to complete and thorough coverage. The contractor shall submit a course outline with associated material to the COR for review and approval prior to scheduling training to ensure the subject matter covers the expectations of the VA and the contractual requirements. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the COR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

**1.25 GOVERNMENT-FURNISHED PROPERTY - NOT USED / NOT APPLICABLE**

**1.26 RELOCATED EQUIPMENT ITEMS**

- A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing equipment and items indicated by symbol "R" or otherwise shown to be relocated by the Contractor.
- B. Perform relocation of such equipment or items at such times and in such a manner as directed by the COR.
- C. Suitably cap existing service lines, such as steam, condensate return, water, drain, gas, air, vacuum and/or electrical, at the main whenever such lines are disconnected from equipment to be relocated. Remove abandoned lines in finished areas and cap as specified herein before under paragraph "Abandoned Lines".
- D. Provide all mechanical and electrical service connections, fittings, fastenings and any other materials necessary for assembly and installation of relocated equipment; and leave such equipment in proper operating condition.
- E. NOT USED
- F. All service lines such as noted above for relocated equipment shall be in place at point of relocation ready for use before any existing equipment is disconnected. Make relocated existing equipment ready for operation or use immediately after reinstallation.

**1.27 STORAGE SPACE FOR DEPARTMENT OF VETERANS AFFAIRS EQUIPMENT -  
NOT USED / NOT APPLICABLE**

**1.28 CONSTRUCTION SIGN**

- A. At the entrance to the Construction Site, a sign must be posted. Sign is detailed in drawings.
  - 1. Before posting sign(s), submit to COR for Approval.

**1.29 SAFETY SIGN**

- A. Provide a Safety Sign as approved and where directed by COR.
- B. All surfaces shall be painted with gloss paint of colors noted.
- C. Maintain sign and remove it when directed by COR.
- D. NOT USED
- E. Post the number of accident free days on a daily basis.

**1.30 PHOTOGRAPHIC DOCUMENTATION**

A. During the construction period through completion, provide photographic documentation of construction progress and at selected milestones (As agreed by the COR):

1. This shall be approved by the COR
2. NOT USED / NOT APPLICABLE

B. Photographic documentation elements:

1. NOT USED / NOT APPLICABLE
2. For all documentation referenced herein, must be organized by both time (date-stamped) and location throughout the project.
3. Documentation shall allow for secure multiple-user access.
4. NOT USED / NOT APPLICABLE
5. NOT USED / NOT APPLICABLE
6. NOT USED / NOT APPLICABLE.
7. As built finished conditions of the interior of each building including floors, ceilings and walls shall be documented at certificate of occupancy or equivalent, or just prior to occupancy, or both, as directed by the COR. Overlapping photographic techniques shall be used to insure maximum coverage.
8. NOT USED / NOT APPLICABLE
9. NOT USED / NOT APPLICABLE
10. NOT USED / NOT APPLICABLE

**1.31 FINAL ELEVATION DIGITAL IMAGES:  
NOT USED / NOT APPLICABLE**

**1.32 HISTORIC PRESERVATION:  
NOT USED / NOT APPLICABLE**

**1.33 VA TRIRIGA CPMS: NOT USED / NOT APPLICABLE**

---END---

**SECTION 01 33 23**  
**SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES**

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
  - A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
  - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
  - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
- 1-5. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by COR on behalf of the Contracting Officer.
- 1-6. Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.
- 1-7. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant

to request therefor by Contracting Officer, adjustment in contract price and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.

- 1-8. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and Architect-Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1-9. Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.
  - A. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.
  - B. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail and shall contain the list of items, name of Medical Center name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
    1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
    2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
    3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.

- C. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.
1. For each drawing required, submit one legible photographic paper or vellum reproducible.
  2. Reproducible shall be full size.
  3. Each drawing shall have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
  4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
  5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
  6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
  7. When work is directly related and involves more than one trade, shop drawings shall be submitted to Architect-Engineer under one cover.
- 1-10. Shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to
- Mechanical Consultant Inc.
- (Architect-Engineer)
- engrs@mciks.com
- 1-11. At the time of transmittal to the Architect-Engineer, the Contractor shall also send a copy of the complete submittal directly to the COR

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**SECTION 01 35 26**  
**SAFETY REQUIREMENTS**  
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**SECTION 01 35 26**  
**SAFETY REQUIREMENTS**

**1.1 APPLICABLE PUBLICATIONS:**

A. Latest publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

B. American Society of Safety Engineers (ASSE):

A10.1-2011.....Pre-Project & Pre-Task Safety and Health  
Planning

A10.34-2012.....Protection of the Public on or Adjacent to  
Construction Sites

A10.38-2013.....Basic Elements of an Employer's Program to  
Provide a Safe and Healthful Work Environment  
American National Standard Construction and  
Demolition Operations

C. American Society for Testing and Materials (ASTM):

E84-2013.....Surface Burning Characteristics of Building  
Materials

D. The Facilities Guidelines Institute (FGI):

FGI Guidelines-2010Guidelines for Design and Construction of  
Healthcare Facilities

E. National Fire Protection Association (NFPA):

10-2013.....Standard for Portable Fire Extinguishers

30-2012.....Flammable and Combustible Liquids Code

51B-2014.....Standard for Fire Prevention During Welding,  
Cutting and Other Hot Work

70-2014.....National Electrical Code

70B-2013.....Recommended Practice for Electrical Equipment  
Maintenance

70E-2012 .....Standard for Electrical Safety in the Workplace

99-2012.....Health Care Facilities Code

241-2013.....Standard for Safeguarding Construction,  
Alteration, and Demolition Operations

F. The Joint Commission (TJC)

TJC Manual .....Comprehensive Accreditation and Certification  
Manual

G. U.S. Nuclear Regulatory Commission

- 10 CFR 20 .....Standards for Protection Against Radiation
- H. U.S. Occupational Safety and Health Administration (OSHA):
  - 29 CFR 1904 .....Reporting and Recording Injuries & Illnesses
  - 29 CFR 1910 .....Safety and Health Regulations for General Industry
  - 29 CFR 1926 .....Safety and Health Regulations for Construction Industry
  - CPL 2-0.124.....Multi-Employer Citation Policy
- I. VHA Directive 2005-007

**1.2 DEFINITIONS:**

- A. OSHA "Competent Person" (CP). One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)).
- B. "Qualified Person" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.
- C. High Visibility Accident. Any mishap which may generate publicity or high visibility.
- D. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.
- E. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:
  - 1. Death, regardless of the time between the injury and death, or the length of the illness;
  - 2. Days away from work (any time lost after day of injury/illness onset);
  - 3. Restricted work;
  - 4. Transfer to another job;
  - 5. Medical treatment beyond first aid;
  - 6. Loss of consciousness; or



7. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

**1.3 REGULATORY REQUIREMENTS:**

- A. In addition to the detailed requirements included in the provisions of this contract, comply with 29 CFR 1926, comply with 29 CFR 1910 as incorporated by reference within 29 CFR 1926, comply with ASSE A10.34, and all applicable federal, state, and local laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern except with specific approval and acceptance by the Resident Engineer.

**1.4 ACCIDENT PREVENTION PLAN (APP):**

- A. The APP (aka Construction Safety & Health Plan) shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and ensure it is site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all worksite safety and health of each subcontractor(s). Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out.
- B. The APP shall be prepared as follows:
  1. Written in English by a qualified person who is employed by the Prime Contractor articulating the specific work and hazards pertaining to the contract (model language can be found in ASSE A10.33). Specifically articulating the safety requirements found within these VA contract safety specifications.
  2. Address both the Prime Contractors and the subcontractors work operations.
  3. State measures to be taken to control hazards associated with materials, services, or equipment provided by suppliers.

4. Address all the elements/sub-elements and in order as follows:
- a. **SIGNATURE SHEET.** Title, signature, and phone number of the following:
    - 1) Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience);
    - 2) Plan approver (company/corporate officers authorized to obligate the company);
    - 3) Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).
  - b. **BACKGROUND INFORMATION.** List the following:
    - 1) Contractor;
    - 2) Contract number;
    - 3) Project name;
    - 4) Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).
  - c. **STATEMENT OF SAFETY AND HEALTH POLICY.** Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor's written safety program goals, objectives, and accident experience goals for this contract should be provided.
  - d. **RESPONSIBILITIES AND LINES OF AUTHORITIES.** Provide the following:
    - 1) A statement of the employer's ultimate responsibility for the implementation of his SOH program;
    - 2) Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.
    - 3) The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA Competent/Qualified Person(s) requirements must be attached.;

- 4) Requirements that no work shall be performed unless a designated competent person is present on the job site;
  - 5) Requirements for pre-task Activity Hazard Analysis (AHAs);
  - 6) Lines of authority;
  - 7) Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;
- e. SUBCONTRACTORS AND SUPPLIERS.** If applicable, provide procedures for coordinating SOH activities with other employers on the job site:
- 1) Identification of subcontractors and suppliers (if known);
  - 2) Safety responsibilities of subcontractors and suppliers.
- f. TRAINING.**
- 1) Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.
  - 2) Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space, etc...) and any requirements for periodic retraining/recertification are required.
  - 3) Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.
  - 4) OSHA 10-hour training is required for all workers on site and the OSHA 30-hour training is required for Trade Competent Persons (CPs)
- g. SAFETY AND HEALTH INSPECTIONS.**
- 1) Specific assignment of responsibilities for a minimum daily job site safety and health inspection during periods of work activity: Who will conduct (e.g., "Site Safety and Health CP"), proof of inspector's training/qualifications, when inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures.

- 2) Any external inspections/certifications that may be required  
(e.g., contracted CSP or CSHT)

**h. ACCIDENT INVESTIGATION & REPORTING.** The Contractor shall conduct mishap investigations of all OSHA Recordable Incidents. The APP shall include accident/incident investigation procedure & identify person(s) responsible to provide the following to the COR

- 1) Exposure data (man-hours worked);
- 2) Accident investigations, reports, and logs.

**i. PLANS (PROGRAMS, PROCEDURES) REQUIRED.** Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address all applicable occupational risks in site-specific compliance and accident prevention plans. These Plans shall include but are not be limited to procedures for addressing the risks associates with the following:

- 1) Emergency response ;
- 2) Contingency for severe weather;
- 3) Fire Prevention ;
- 4) Medical Support;
- 5) Posting of emergency telephone numbers;
- 6) Prevention of alcohol and drug abuse;
- 7) Site sanitation (housekeeping, drinking water, toilets);
- 8) Night operations and lighting ;
- 9) Hazard communication program;
- 10) Welding/Cutting "Hot" work ;
- 11) Electrical Safe Work Practices (Electrical LOTO/NFPA 70E);
- 12) General Electrical Safety
- 13) Hazardous energy control (Machine LOTO);
- 14) Site-Specific Fall Protection & Prevention;
- 15) Excavation/trenching;
- 16) Asbestos abatement;
- 17) Lead abatement;
- 18) Crane Critical lift;
- 19) Respiratory protection;
- 20) Health hazard control program;

- 21) Radiation Safety Program;
- 22) Abrasive blasting;
- 23) Heat/Cold Stress Monitoring;
- 24) Crystalline Silica Monitoring (Assessment);
- 25) Demolition plan (to include engineering survey);
- 26) Formwork and shoring erection and removal;
- 27) PreCast Concrete.

- C. Submit the APP to the COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.
- D. Once accepted by the COR the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.
- E. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the COR. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSE/SAFE A10.34) and the environment.

**1.5 ACTIVITY HAZARD ANALYSES (AHAS):**

- A. AHAs are also known as Job Hazard Analyses, Job Safety Analyses, and Activity Safety Analyses. Before beginning each work activity involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or sub-contractor is to perform the work, the Contractor(s) performing that work activity shall prepare an AHA (Example electronic AHA forms can be found on the US Army Corps of Engineers web site)
- B. AHAs shall define the activities being performed and identify the work sequences, the specific anticipated hazards, site conditions,

equipment, materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk.

- C. Work shall not begin until the AHA for the work activity has been accepted by the COR and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.
1. The names of the Competent/Qualified Person(s) required for a particular activity (for example, excavations, scaffolding, fall protection, other activities as specified by OSHA and/or other State and Local agencies) shall be identified and included in the AHA. Certification of their competency/qualification shall be submitted to the Government Designated Authority (GDA) for acceptance prior to the start of that work activity.
  2. The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified person(s).
    - a. If more than one Competent/Qualified Person is used on the AHA activity, a list of names shall be submitted as an attachment to the AHA. Those listed must be Competent/Qualified for the type of work involved in the AHA and familiar with current site safety issues.
    - b. If a new Competent/Qualified Person (not on the original list) is added, the list shall be updated (an administrative action not requiring an updated AHA). The new person shall acknowledge in writing that he or she has reviewed the AHA and is familiar with current site safety issues.
  3. Submit AHAs to the COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES for review at least 15 calendar days prior to the start of each phase. Subsequent AHAs as shall be formatted as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

4. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.
5. Develop the activity hazard analyses using the project schedule as the basis for the activities performed. All activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier, or subcontractor and provided to the prime contractor for review and approval and then submitted to the COR.

**1.6 PRECONSTRUCTION CONFERENCE:**

- A. Contractor representatives who have a responsibility or significant role in implementation of the accident prevention program, as required by 29 CFR 1926.20(b)(1), on the project shall attend the preconstruction conference to gain a mutual understanding of its implementation. This includes the project superintendent, subcontractor superintendents, and any other assigned safety and health professionals.
- B. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.
- C. Deficiencies in the submitted APP will be brought to the attention of the Contractor within 14 days of submittal, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Do not begin work until there is an accepted APP.

**1.7 "SITE SAFETY AND HEALTH OFFICER" (SSHO) AND "COMPETENT PERSON" (CP):**

- A. The Prime Contractor shall designate a minimum of one SSHO at each project site that will be identified as the SSHO to administer the Contractor's safety program and government-accepted Accident Prevention Plan. Each subcontractor shall designate a minimum of one CP in compliance with 29 CFR 1926.20 (b)(2) that will be identified as a CP to administer their individual safety programs.

- B. Further, all specialized Competent Persons for the work crews will be supplied by the respective contractor as required by 29 CFR 1926 (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).
- C. These Competent Persons can have collateral duties as the subcontractor's superintendent and/or work crew lead persons as well as fill more than one specialized CP role (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).
- D. The SSHO or an equally-qualified Designated Representative/alternate will maintain a presence on the site during construction operations in accordance with FAR Clause 52.236-6: *Superintendence by the Contractor*. CPs will maintain presence during their construction activities in accordance with above mentioned clause. A listing of the designated SSHO and all known CPs shall be submitted prior to the start of work as part of the APP with the training documentation and/or AHA as listed in Section 1.8 below.
- E. The repeated presence of uncontrolled hazards during a contractor's work operations will result in the designated CP as being deemed incompetent and result in the required removal of the employee in accordance with FAR Clause 52.236-5: *Material and Workmanship*, Paragraph (c).

**1.8 TRAINING:**

- A. The designated Prime Contractor SSHO must meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the requirements of 29 CFR 1926.16 and other appropriate Federal, State and local requirements are met for the project. As a minimum the SSHO must have completed the OSHA 30-hour Construction Safety class and have five (5) years of construction industry safety experience or three (3) years if he/she possesses a Certified Safety Professional (CSP) or certified Construction Safety and Health Technician (CSHT) certification or have a safety and health degree from an accredited university or college.
- B. All designated CPs shall have completed the OSHA 30-hour Construction Safety course within the past 5 years.



- C. In addition to the OSHA 30 Hour Construction Safety Course, all CPs with high hazard work operations such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations shall have a specialized formal course in the hazard recognition & control associated with those high hazard work operations. Documented "repeat" deficiencies in the execution of safety requirements will require retaking the requisite formal course.
- D. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course and any necessary safety training to be able to identify hazards within their work environment.
- E. Submit training records associated with the above training requirements to the COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance.
- F. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the SSHO or his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, emergency procedures, accident reporting etc... Documentation shall be provided to the COR that individuals have undergone contractor's safety briefing.
- G. Ongoing safety training will be accomplished in the form of weekly documented safety meeting.

**1.9 INSPECTIONS:**

- A. The SSHO shall conduct frequent and regular safety inspections (daily) of the site and each of the subcontractors CPs shall conduct frequent and regular safety inspections (daily) of the their work operations as required by 29 CFR 1926.20(b)(2). Each week, the SSHO shall conduct a formal documented inspection of the entire construction areas with the subcontractors' "Trade Safety and Health CPs" present in their work areas. Coordinate with, and report findings and corrective actions weekly to COR.

**1.10 ACCIDENTS, OSHA 300 LOGS, AND MAN-HOURS:**

- A. Notify the COR as soon as practical, but no more than four hours after any accident meeting the definition of OSHA Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than \$5,000, or any weight handling equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the COR determine whether a government investigation will be conducted.
- B. Conduct an accident investigation for recordable injuries and illnesses, for Medical Treatment defined in paragraph DEFINITIONS, and property damage accidents resulting in at least \$20,000 in damages, to establish the root cause(s) of the accident. Complete the VA Form 2162, and provide the report to the COR within 5 calendar days of the accident. The COR will provide copies of any required or special forms.
- C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be reported to the Resident Engineer monthly.
- D. A summation of all OSHA recordable accidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the COR monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Resident Engineer as requested.

**1.11 PERSONAL PROTECTIVE EQUIPMENT (PPE):**

- A. PPE is governed in all areas by the nature of the work the employee is performing. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.
- B. Mandatory PPE includes:
  - 1. Hard Hats - unless written authorization is given by the COR in circumstances of work operations that have limited potential for falling object hazards such as during finishing work

- or minor remodeling. With authorization to relax the requirement of hard hats, if a worker becomes exposed to an overhead falling object hazard, then hard hats would be required in accordance with the OSHA regulations.
2. Safety glasses - unless written authorization is given by the COR appropriate safety glasses meeting the ANSI Z.87.1 standard must be worn by each person on site.
  3. Appropriate Safety Shoes - based on the hazards present, safety shoes meeting the requirements of ASTM F2413-11 shall be worn by each person on site unless written authorization is given by the COR.
  4. Hearing protection - Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.

#### 1.12 INFECTION CONTROL

- A. Infection Control is critical in all medical center facilities. Interior construction activities causing disturbance of existing dust, or creating new dust, must be conducted within ventilation-controlled areas that minimize the flow of airborne particles into patient areas.
- B. An AHA associated with infection control will be performed by VA personnel in accordance with FGI Guidelines (i.e. Infection Control Risk Assessment (ICRA)). The ICRA procedure found on the American Society for Healthcare Engineering (ASHE) website will be utilized. Risk classifications of Class II or lower will require approval by the COR before beginning any construction work. Risk classifications of Class III or higher will require a permit before beginning any construction work. Infection Control permits will be issued by the COR. The Infection Control Permits will be posted outside the appropriate construction area. More than one permit may be issued for a construction project if the work is located in separate areas requiring separate classes. The primary project scope area for this project is: **Class**, however, work outside the primary project scope area may vary. The required infection control precautions with each class are as follows:
  1. Class I requirements:
    - a. During Construction Work:
      - 1) Notify the COR

- 2) Execute work by methods to minimize raising dust from construction operations.
  - 3) Ceiling tiles: Immediately replace a ceiling tiles displaced for visual inspection.
- b. Upon Completion:
- 1) Clean work area upon completion of task
  - 2) Notify the COR
2. Class II requirements:
- a. During Construction Work:
- 1) Notify the COR
  - 2) Provide active means to prevent airborne dust from dispersing into atmosphere such as wet methods or tool mounted dust collectors where possible.
  - 3) Water mist work surfaces to control dust while cutting.
  - 4) Seal unused doors with duct tape.
  - 5) Block off and seal air vents.
  - 6) Remove or isolate HVAC system in areas where work is being performed.
- b. Upon Completion:
- 1) Wipe work surfaces with cleaner/disinfectant.
  - 2) Contain construction waste before transport in tightly covered containers.
  - 3) Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area.
  - 4) Upon completion, restore HVAC system where work was performed
  - 5) Notify the RCOR
3. Class III requirements:
- a. During Construction Work:
- 1) Obtain permit from the COR
  - 2) Remove or Isolate HVAC system in area where work is being done to prevent contamination of duct system.
  - 3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit)

before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.

- 4) Maintain negative air pressure, 0.01 inches of water gauge, within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording and alarm instrument, which must be calibrated on installation, maintained with periodic calibration and monitored by the contractor.
- 5) Contain construction waste before transport in tightly covered containers.
- 6) Cover transport receptacles or carts. Tape covering unless solid lid.

b. Upon Completion:

- 1) Do not remove barriers from work area until completed project is inspected by the COR and thoroughly cleaned by the VA Environmental Services Department.
- 2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
- 3) Vacuum work area with HEPA filtered vacuums.
- 4) Wet mop area with cleaner/disinfectant.
- 5) Upon completion, restore HVAC system where work was performed.
- 6) Return permit to the COR

4. Class IV requirements:

a. During Construction Work:

- 1) Obtain permit from the COR
- 2) Isolate HVAC system in area where work is being done to prevent contamination of duct system.
- 3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
- 4) Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.

- 5) Seal holes, pipes, conduits, and punctures.
- 6) Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave work site.
- 7) All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area.

b. Upon Completion:

- 1) Do not remove barriers from work area until completed project is inspected by the COR with thorough cleaning by the VA Environmental Services Dept.
- 2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
- 3) Contain construction waste before transport in tightly covered containers.
- 4) Cover transport receptacles or carts. Tape covering unless solid lid.
- 5) Vacuum work area with HEPA filtered vacuums.
- 6) Wet mop area with cleaner/disinfectant.
- 7) Upon completion, restore HVAC system where work was performed.
- 8) Return permit to the COR

C. Barriers shall be erected as required based upon classification (Class III & IV requires barriers) and shall be constructed as follows:

1. Class III and IV - closed door with masking tape applied over the frame and door is acceptable for projects that can be contained in a single room.
2. Construction, demolition or reconstruction not capable of containment within a single room must have the following barriers erected and made presentable on hospital occupied side:
  - a. Class III & IV (where dust control is the only hazard, and an agreement is reached with the COR and Medical Center) - Airtight plastic barrier that extends from the floor to

ceiling. Seams must be sealed with duct tape to prevent dust and debris from escaping

- b. Class III & IV - Drywall barrier erected with joints covered or sealed to prevent dust and debris from escaping.
  - c. Class III & IV - Seal all penetrations in existing barrier airtight
  - d. Class III & IV - Barriers at penetration of ceiling envelopes, chases and ceiling spaces to stop movement air and debris
  - e. Class IV only - Anteroom or double entrance openings that allow workers to remove protective clothing or vacuum off existing clothing
  - f. Class III & IV - At elevators shafts or stairways within the field of construction, overlapping flap minimum of two feet wide of polyethylene enclosures for personnel access.
- D. Products and Materials:
- 1. Sheet Plastic: Fire retardant polystyrene, 6-mil thickness meeting local fire codes
  - 2. Barrier Doors: Self Closing One-hour solid core wood in steel frame, painted
  - 3. Dust proof one-hour drywall
  - 4. High Efficiency Particulate Air-Equipped filtration machine rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer's instructions.
  - 5. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose
  - 6. Adhesive Walk-off Mats: Provide minimum size mats of 24 inches x 36 inches
  - 7. Disinfectant: Hospital-approved disinfectant or equivalent product
  - 8. Portable Ceiling Access Module
- E. Before any construction on site begins, all contractor personnel involved in the construction or renovation activity shall be educated

and trained in infection prevention measures established by the medical center.

- F. A dust control program will be establish and maintained as part of the contractor's infection preventive measures in accordance with the FGI Guidelines for Design and Construction of Healthcare Facilities. Prior to start of work, prepare a plan detailing project-specific dust protection measures with associated product data, including periodic status reports, and submit to COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- G. Medical center Infection Control personnel will monitor for airborne disease (e.g. aspergillosis) during construction. A baseline of conditions will be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality with safe thresholds established.
- H. In general, the following preventive measures shall be adopted during construction to keep down dust and prevent mold.
  - 1. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. HEPA filtration is required where the exhaust dust may reenter the medical center.
  - 2. Exhaust hoses shall be exhausted so that dust is not reintroduced to the medical center.
  - 3. Adhesive Walk-off/Carpet Walk-off Mats shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
  - 4. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as it is created. Transport these outside the construction area in containers with tightly fitting lids.
  - 5. The contractor shall not haul debris through patient-care areas without prior approval of the COR and the Medical Center. When, approved, debris shall be hauled in enclosed dust



- proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
6. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.
  7. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.
- I. Final Cleanup:
1. Routine cleaning shall be performed, in addition to complete cleaning in the final stages. Remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of construction.
  2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
  3. All new air ducts shall be cleaned prior to final inspection.
- 1.13 TUBERCULOSIS SCREENING**
- A. Contractor shall provide written certification that all contract employees assigned to the work site have had a pre-placement tuberculin screening within 90 days prior to assignment to the worksite and been found have negative TB screening reactions. Contractors shall be required to show documentation of negative TB screening reactions for any additional workers who are added after the 90-day requirement before they will be allowed to work on the work site. NOTE: This can be the Center for Disease Control (CDC) and Prevention and two-step skin testing or a Food and Drug Administration (FDA)-approved blood test.
1. Contract employees manifesting positive screening reactions to the tuberculin shall be examined according to current CDC guidelines prior to working on VHA property.

2. Subsequently, if the employee is found without evidence of active (infectious) pulmonary TB, a statement documenting examination by a physician shall be on file with the employer (construction contractor), noting that the employee with a positive tuberculin screening test is without evidence of active (infectious) pulmonary TB.
3. If the employee is found with evidence of active (infectious) pulmonary TB, the employee shall require treatment with a subsequent statement to the fact on file with the employer before being allowed to return to work on VHA property.

#### **1.14 FIRE SAFETY**

- A. Fire Safety Plan: Establish and maintain a site-specific fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. This plan may be an element of the Accident Prevention Plan.
- B. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- C. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- D. Temporary Construction Partitions:
  1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas and adjoining areas. Construct partitions of gypsum board or treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on both sides of fire retardant treated wood or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.
  2. Install one-hour temporary construction partitions as shown on drawings to maintain integrity of existing exit stair enclosures,

- exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.
3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.
- E. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- F. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with COR.
- G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COR
- H. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- I. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- J. Standpipes: Not Applicable
- K. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.
- L. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with COR All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the COR.
- M. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with COR.

- N. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR at least 8hours in advance Designate contractor's responsible project-site fire prevention program manager to permit hot work.
- O. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to COR
- P. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- Q. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- R. If required, submit documentation to the COR that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

**1.15 ELECTRICAL**

- A. All electrical work shall comply with NFPA 70 (NEC), NFPA 70B, NFPA 70E, 29 CFR Part 1910 Subpart J - General Environmental Controls, 29 CFR Part 1910 Subpart S - Electrical, and 29 CFR 1926 Subpart K in addition to other references required by contract.
- B. All qualified persons performing electrical work under this contract shall be licensed journeyman or master electricians. All apprentice electricians performing under this contract shall be deemed unqualified persons unless they are working under the immediate supervision of a licensed electrician or master electrician.
- C. All electrical work will be accomplished de-energized and in the Electrically Safe Work Condition ( refer to NFPA 70E for Work Involving Electrical Hazards, including Exemptions to Work Permit). Any Contractor, subcontractor or temporary worker who fails to fully comply with this requirement is subject to immediate termination in accordance with FAR clause 52.236-5(c). Only in rare circumstance where achieving an electrically safe work condition prior to beginning work would increase or cause additional hazards, or is infeasible due to equipment design or operational limitations is energized work permitted. The COR with approval of the Medical Center Director will make the determination if the circumstances would meet the exception

outlined above. An AHA specific to energized work activities will be developed, reviewed, and accepted prior to the start of that work.

1. Development of a Hazardous Electrical Energy Control Procedure is required prior to de-energization. A single Simple Lockout/Tagout Procedure for multiple work operations can only be used for work involving qualified person(s) de-energizing one set of conductors or circuit part source. Task specific Complex Lockout/Tagout Procedures are required at all other times.
2. Verification of the absence of voltage after de-energization and lockout/tagout is considered "energized electrical work" (live work) under NFPA 70E, and shall only be performed by qualified persons wearing appropriate shock protective (voltage rated) gloves and arc rate personal protective clothing and equipment, using Underwriters Laboratories (UL) tested and appropriately rated contact electrical testing instruments or equipment appropriate for the environment in which they will be used.
3. Personal Protective Equipment (PPE) and electrical testing instruments will be readily available for inspection by the The COR Before beginning any electrical work, an Activity Hazard Analysis (AHA) will be conducted to include Shock Hazard and Arc Flash Hazard analyses (NFPA Tables can be used only as a last alternative and it is strongly suggested a full Arc Flash Hazard Analyses be conducted). Work shall not begin until the AHA for the work activity has been accepted by the COR and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

- D. Ground-fault circuit interrupters. All 120-volt, single-phase 15- and 20-ampere receptacle outlets on construction sites shall have approved ground-fault circuit interrupters for personnel protection. "Assured Equipment Grounding Conductor Program" only is not allowed.

#### **1.16 FALL PROTECTION**

- A. The fall protection (FP) threshold height requirement is 6 ft (1.8 m) for ALL WORK, unless specified differently or the OSHA 29 CFR 1926 requirements are more stringent, to include steel erection activities, systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work.

1. The use of a Safety Monitoring System (SMS) as a fall protection method is prohibited.
2. The use of Controlled Access Zone (CAZ) as a fall protection method is prohibited.
3. A Warning Line System (WLS) may ONLY be used on floors or flat or low-sloped roofs (between 0 - 18.4 degrees or 4:12 slope) and shall be erected around all sides of the work area (See 29 CFR 1926.502(f) for construction of WLS requirements). Working within the WLS does not require FP. No worker shall be allowed in the area between the roof or floor edge and the WLS without FP. FP is required when working outside the WLS.
4. Fall protection while using a ladder will be governed by the OSHA requirements.

#### **1.17 SCAFFOLDS AND OTHER WORK PLATFORMS**

- A. All scaffolds and other work platforms construction activities shall comply with 29 CFR 1926 Subpart L.
- B. The fall protection (FP) threshold height requirement is 6 ft (1.8 m) as stated in Section 1.16.
- C. The following hierarchy and prohibitions shall be followed in selecting appropriate work platforms.
  1. Scaffolds, platforms, or temporary floors shall be provided for all work except that can be performed safely from the ground or similar footing.
  2. Ladders less than 20 feet may be used as work platforms only when use of small hand tools or handling of light material is involved.
  3. Ladder jacks, lean-to, and prop-scaffolds are prohibited.
  4. Emergency descent devices shall not be used as working platforms.
- D. Contractors shall use a scaffold tagging system in which all scaffolds are tagged by the Competent Person. Tags shall be color-coded: green indicates the scaffold has been inspected and is safe to use; red indicates the scaffold is unsafe to use. Tags shall be readily visible, made of materials that will withstand the environment in which they are used, be legible and shall include:
  1. The Competent Person's name and signature;
  2. Dates of initial and last inspections.

- E. Mast Climbing work platforms: When access ladders, including masts designed as ladders, exceed 20 ft (6 m) in height, positive fall protection shall be used.

**1.18 NOT USED**

**1.19 NOT USED**

**1.20 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)**

- A. All installation, maintenance, and servicing of equipment or machinery shall comply with 29 CFR 1910.147 except for specifically referenced operations in 29 CFR 1926 such as concrete & masonry equipment [1926.702(j)], heavy machinery & equipment [1926.600(a)(3)(i)], and process safety management of highly hazardous chemicals (1926.64). Control of hazardous electrical energy during the installation, maintenance, or servicing of electrical equipment shall comply with Section 1.15 to include NFPA 70E and other VA specific requirements discussed in the section.

**1.21 NOT USED**

**1.22 WELDING AND CUTTING**

- As specified in section 1.14, Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR Obtain permits from COR at least 8 hours in advance Designate contractor's responsible project-site fire prevention program manager to permit hot work.

**1.23 LADDERS**

- A. All Ladder use shall comply with 29 CFR 1926 Subpart X.
- B. All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.
- C. Manufacturer safety labels shall be in place on ladders
- D. Step Ladders shall not be used in the closed position
- E. Top steps or cap of step ladders shall not be used as a step
- F. Portable ladders, used as temporary access, shall extend at least 3 ft (0.9 m) above the upper landing surface.
  - 1. When a 3 ft (0.9-m) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist workers in mounting and dismounting the ladder.
  - 2. In no case shall the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.

- G. Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or damaged ladders shall be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design.

**1.24 FLOOR & WALL OPENINGS**

- A. All floor and wall openings shall comply with 29 CFR 1926 Subpart M.
- B. Floor and roof holes/openings are any that measure over 2 in (51 mm) in any direction of a walking/working surface which persons may trip or fall into or where objects may fall to the level below. See 21.F for covering and labeling requirements. Skylights located in floors or roofs are considered floor or roof hole/openings.
- C. All floor, roof openings or hole into which a person can accidentally walk or fall through shall be guarded either by a railing system with toeboards along all exposed sides or a load-bearing cover. When the cover is not in place, the opening or hole shall be protected by a removable guardrail system or shall be attended when the guarding system has been removed, or other fall protection system.
  - 1. Covers shall be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.
  - 2. Covers shall be secured when installed, clearly marked with the word "HOLE", "COVER" or "Danger, Roof Opening-Do Not Remove" or color-coded or equivalent methods (e.g., red or orange "X"). Workers must be made aware of the meaning for color coding and equivalent methods.
  - 3. Roofing material, such as roofing membrane, insulation or felts, covering or partly covering openings or holes, shall be immediately cut out. No hole or opening shall be left unattended unless covered.
  - 4. Non-load-bearing skylights shall be guarded by a load-bearing skylight screen, cover, or railing system along all exposed sides.
  - 5. Workers are prohibited from standing/walking on skylights.

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**SECTION 01 42 19**  
**REFERENCE STANDARDS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

**1.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS FPMR PART 101-29 (FAR 52.211-1) (AUG 1998)**

- A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to - GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.
- B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

**1.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-4) (JUN 1988)**

The specifications and standards cited in this solicitation can be examined at the following location:

DEPARTMENT OF VETERANS AFFAIRS  
Office of Construction & Facilities Management  
Facilities Quality Service (00CFM1A)  
425 Eye Street N.W, (sixth floor)  
Washington, DC 20001  
Telephone Numbers: (202) 632-5249 or (202) 632-5178  
Between 9:00 AM - 3:00 PM

**1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-3) (JUN 1988)**

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

AA	Aluminum Association Inc. <a href="http://www.aluminum.org">http://www.aluminum.org</a>
AABC	Associated Air Balance Council <a href="http://www.aabchq.com">http://www.aabchq.com</a>
AAMA	American Architectural Manufacturer's Association <a href="http://www.aamanet.org">http://www.aamanet.org</a>
AAN	American Nursery and Landscape Association <a href="http://www.anla.org">http://www.anla.org</a>
AASHTO	American Association of State Highway and Transportation Officials <a href="http://www.aashto.org">http://www.aashto.org</a>
AATCC	American Association of Textile Chemists and Colorists <a href="http://www.aatcc.org">http://www.aatcc.org</a>
ACGIH	American Conference of Governmental Industrial Hygienists <a href="http://www.acgih.org">http://www.acgih.org</a>
ACI	American Concrete Institute <a href="http://www.aci-int.net">http://www.aci-int.net</a>
ACPA	American Concrete Pipe Association <a href="http://www.concrete-pipe.org">http://www.concrete-pipe.org</a>
ACPPA	American Concrete Pressure Pipe Association <a href="http://www.acppa.org">http://www.acppa.org</a>
ADC	Air Diffusion Council <a href="http://flexibleduct.org">http://flexibleduct.org</a>
AGA	American Gas Association <a href="http://www.aga.org">http://www.aga.org</a>
AGC	Associated General Contractors of America <a href="http://www.agc.org">http://www.agc.org</a>
AGMA	American Gear Manufacturers Association, Inc. <a href="http://www.agma.org">http://www.agma.org</a>
AHAM	Association of Home Appliance Manufacturers <a href="http://www.aham.org">http://www.aham.org</a>
AISC	American Institute of Steel Construction <a href="http://www.aisc.org">http://www.aisc.org</a>
AISI	American Iron and Steel Institute <a href="http://www.steel.org">http://www.steel.org</a>
AITC	American Institute of Timber Construction <a href="http://www.aitc-glulam.org">http://www.aitc-glulam.org</a>
AMCA	Air Movement and Control Association, Inc. <a href="http://www.amca.org">http://www.amca.org</a>
ANLA	American Nursery & Landscape Association <a href="http://www.anla.org">http://www.anla.org</a>

ANSI American National Standards Institute, Inc.  
<http://www.ansi.org>

APA The Engineered Wood Association  
<http://www.apawood.org>

ARI Air-Conditioning and Refrigeration Institute  
<http://www.ari.org>

ASAE American Society of Agricultural Engineers  
<http://www.asae.org>

ASCE American Society of Civil Engineers  
<http://www.asce.org>

ASHRAE American Society of Heating, Refrigerating, and  
Air-Conditioning Engineers  
<http://www.ashrae.org>

ASME American Society of Mechanical Engineers  
<http://www.asme.org>

ASSE American Society of Sanitary Engineering  
<http://www.asse-plumbing.org>

ASTM American Society for Testing and Materials  
<http://www.astm.org>

AWI Architectural Woodwork Institute  
<http://www.awinet.org>

AWS American Welding Society  
<http://www.aws.org>

AWWA American Water Works Association  
<http://www.awwa.org>

BHMA Builders Hardware Manufacturers Association  
<http://www.buildershardware.com>

BIA Brick Institute of America  
<http://www.bia.org>

CAGI Compressed Air and Gas Institute  
<http://www.cagi.org>

CGA Compressed Gas Association, Inc.  
<http://www.cganet.com>

CI The Chlorine Institute, Inc.  
<http://www.chlorineinstitute.org>

CISCA Ceilings and Interior Systems Construction Association  
<http://www.cisca.org>

CISPI Cast Iron Soil Pipe Institute  
<http://www.cispi.org>

CLFMI Chain Link Fence Manufacturers Institute  
<http://www.chainlinkinfo.org>

CPMB Concrete Plant Manufacturers Bureau  
<http://www.cpmb.org>

CRA California Redwood Association  
<http://www.calredwood.org>

CRSI Concrete Reinforcing Steel Institute  
<http://www.crsi.org>

CTI Cooling Technology Institute  
<http://www.cti.org>

DHI Door and Hardware Institute  
<http://www.dhi.org>

EGSA Electrical Generating Systems Association  
<http://www.egsa.org>

EEI Edison Electric Institute  
<http://www.eei.org>

EPA Environmental Protection Agency  
<http://www.epa.gov>

ETL ETL Testing Laboratories, Inc.  
<http://www.etl.com>

FAA Federal Aviation Administration  
<http://www.faa.gov>

FCC Federal Communications Commission  
<http://www.fcc.gov>

FPS The Forest Products Society  
<http://www.forestprod.org>

GANA Glass Association of North America  
<http://www.cssinfo.com/info/gana.html/>

FM Factory Mutual Insurance  
<http://www.fmglobal.com>

GA Gypsum Association  
<http://www.gypsum.org>

GSA General Services Administration  
<http://www.gsa.gov>

HI Hydraulic Institute  
<http://www.pumps.org>

HPVA Hardwood Plywood & Veneer Association  
<http://www.hpva.org>

ICBO International Conference of Building Officials  
<http://www.icbo.org>

ICEA Insulated Cable Engineers Association Inc.  
<http://www.icea.net>

\ICAC Institute of Clean Air Companies  
<http://www.icac.com>

IEEE Institute of Electrical and Electronics Engineers  
<http://www.ieee.org>

IMSA International Municipal Signal Association  
<http://www.imsasafety.org>

IPCEA Insulated Power Cable Engineers Association

NBMA Metal Buildings Manufacturers Association  
<http://www.mbma.com>

MSS Manufacturers Standardization Society of the Valve and Fittings Industry Inc.  
<http://www.mss-hq.com>

NAAMM National Association of Architectural Metal Manufacturers  
<http://www.naamm.org>

NAPHCC Plumbing-Heating-Cooling Contractors Association  
<http://www.phccweb.org.org>

NBS National Bureau of Standards  
See - NIST

NBBPVI National Board of Boiler and Pressure Vessel Inspectors  
<http://www.nationboard.org>

NEC National Electric Code  
See - NFPA National Fire Protection Association

NEMA National Electrical Manufacturers Association  
<http://www.nema.org>

NFPA National Fire Protection Association  
<http://www.nfpa.org>

NHLA National Hardwood Lumber Association  
<http://www.natlhardwood.org>

NIH National Institute of Health  
<http://www.nih.gov>

NIST National Institute of Standards and Technology  
<http://www.nist.gov>

NLMA Northeastern Lumber Manufacturers Association, Inc.  
<http://www.nelma.org>

NPA National Particleboard Association  
18928 Premiere Court  
Gaithersburg, MD 20879  
(301) 670-0604

NSF National Sanitation Foundation  
<http://www.nsf.org>

NWDA Window and Door Manufacturers Association  
<http://www.nwwda.org>

OSHA Occupational Safety and Health Administration  
Department of Labor  
<http://www.osha.gov>

PCA Portland Cement Association  
<http://www.portcement.org>

PCI Precast Prestressed Concrete Institute  
<http://www.pci.org>

PPI The Plastic Pipe Institute  
<http://www.plasticpipe.org>

PEI Porcelain Enamel Institute, Inc.  
<http://www.porcelainenamel.com>

PTI Post-Tensioning Institute  
<http://www.post-tensioning.org>

RFCI The Resilient Floor Covering Institute  
<http://www.rfci.com>

RIS Redwood Inspection Service  
See - CRA

RMA Rubber Manufacturers Association, Inc.  
<http://www.rma.org>

SCMA Southern Cypress Manufacturers Association  
<http://www.cypressinfo.org>

SDI Steel Door Institute  
<http://www.steeldoor.org>

IGMA Insulating Glass Manufacturers Alliance  
<http://www.igmaonline.org>

SJI Steel Joist Institute  
<http://www.steeljoist.org>

SMACNA Sheet Metal and Air-Conditioning Contractors  
National Association, Inc.  
<http://www.smacna.org>

SSPC The Society for Protective Coatings  
<http://www.sspc.org>

STI Steel Tank Institute  
<http://www.steeltank.com>

SWI Steel Window Institute  
<http://www.steelwindows.com>

TCA Tile Council of America, Inc.  
<http://www.tileusa.com>

TEMA Tubular Exchange Manufacturers Association  
<http://www.tema.org>

TPI Truss Plate Institute, Inc.  
583 D'Onofrio Drive; Suite 200  
Madison, WI 53719  
(608) 833-5900

UBC The Uniform Building Code  
See ICBO

UL Underwriters' Laboratories Incorporated  
<http://www.ul.com>

ULC Underwriters' Laboratories of Canada  
<http://www.ulc.ca>

WCLIB West Coast Lumber Inspection Bureau  
6980 SW Varns Road, P.O. Box 23145  
Portland, OR 97223  
(503) 639-0651

WRCLA Western Red Cedar Lumber Association  
P.O. Box 120786  
New Brighton, MN 55112  
(612) 633-4334

WWPA Western Wood Products Association  
<http://www.wwpa.org>

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**SECTION 01 58 16**  
**TEMPORARY INTERIOR SIGNAGE**

**PART 1 GENERAL**

**DESCRIPTION**

This section specifies temporary interior signs.

**PART 2 PRODUCTS**

**2.1 TEMPORARY SIGNS**

- A. Fabricate from 50 Kg (110 pound) mat finish white paper.
- B. Cut to 100 mm (4-inch) wide by 300 mm (12 inch) long size tag.
- C. Punch 3 mm (1/8-inch) diameter hole centered on 100 mm (4-inch) dimension of tag. Edge of Hole spaced approximately 13 mm (1/2-inch) from one end on tag.
- D. Reinforce hole on both sides with gummed cloth washer or other suitable material capable of preventing tie pulling through paper edge.
- E. Ties: Steel wire 0.3 mm (0.0120-inch) thick, attach to tag with twisstie, leaving 150 mm (6-inch) long free ends.
- F. All signage will be coordinated with COR.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. Install temporary signs attached to room door frame or room door knob, lever, or pull for doors on corridor openings.
- B. Mark on signs with felt tip marker having approximately 3 mm (1/8-inch) wide stroke for clearly legible numbers or letters.
- C. Identify room with numbers as designated on floor plans.

**3.2 LOCATION**

- A. Install on doors that have room, corridor, and space numbers shown.
- B. Doors that do not require signs are as follows:
  - 1. Corridor barrier doors (cross-corridor) in corridor with same number.
  - 2. Folding doors or partitions.
  - 3. Toilet or bathroom doors within and between rooms.
  - 4. Communicating doors in partitions between rooms with corridor entrance doors.
  - 5. Closet doors within rooms.
- C. Replace missing, damaged, or illegible signs.

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**SECTION 01 74 19**  
**CONSTRUCTION WASTE MANAGEMENT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
  - 1. Waste Management Plan development and implementation.
  - 2. Techniques to minimize waste generation.
  - 3. Sorting and separating of waste materials.
  - 4. Salvage of existing materials and items for reuse or resale.
  - 5. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
  - 1. Soil.
  - 2. Inerts (eg, concrete, masonry and asphalt).
  - 3. Clean dimensional wood and palette wood.
  - 4. Green waste (biodegradable landscaping materials).
  - 5. Engineered wood products (plywood, particle board and I-joists, etc).
  - 6. Metal products (eg, steel, wire, beverage containers, copper, etc).
  - 7. Cardboard, paper and packaging.
  - 8. Bitumen roofing materials.
  - 9. Plastics (eg, ABS, PVC).
  - 10. Carpet and/or pad.
  - 11. Gypsum board.
  - 12. Insulation.
  - 13. Paint.
  - 14. Fluorescent lamps.

**1.2 RELATED WORK**

- A. Section 02 41 00, DEMOLITION.

B. Section 01 00 00, GENERAL REQUIREMENTS.

**1.3 QUALITY ASSURANCE**

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
1. Excess or unusable construction materials.
  2. Packaging used for construction products.
  3. Poor planning and/or layout.
  4. Construction error.
  5. Over ordering.
  6. Weather damage.
  7. Contamination.
  8. Mishandling.
  9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.cwm.wbdg.org> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

#### **1.4 TERMINOLOGY**

- A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.
- B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.
- C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.
- D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.
- E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
- F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
- G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.
- H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.
- J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.

- K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.
- L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
  - 1. On-site Recycling - Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
  - 2. Off-site Recycling - Materials hauled to a location and used in an altered form in the manufacture of new products.
- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.
- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.
- P. Salvage: To remove waste materials from the site for resale or re-use by a third party.
- Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.
- R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

#### **1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:

- B. Prepare and submit to the Contracting Officer's Representative a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
1. Procedures to be used for debris management.
  2. Techniques to be used to minimize waste generation.
  3. Analysis of the estimated job site waste to be generated:
    - a. List of each material and quantity to be salvaged, reused, recycled.
    - b. List of each material and quantity proposed to be taken to a landfill.
  4. Detailed description of the Means/Methods to be used for material handling.
    - a. On site: Material separation, storage, protection where applicable.
    - b. Off site: Transportation means and destination. Include list of materials.
      - 1) Description of materials to be site-separated and self-hauled to designated facilities.
      - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
    - c. The names and locations of mixed debris reuse and recycling facilities or sites.
    - d. The names and locations of trash disposal landfill facilities or sites.
    - e. Documentation that the facilities or sites are approved to receive the materials.
- C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

#### **1.6 APPLICABLE PUBLICATIONS**

- A Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.

B. U.S. Green Building Council (USGBC):

LEED Green Building Rating System for New Construction

**1.7 RECORDS**

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. List of each material and quantity to be salvaged, recycled, reused.
- B. List of each material and quantity proposed to be taken to a landfill.
- C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

**PART 3 - EXECUTION**

**3.1 COLLECTION**

- A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.
- B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.
- C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

**3.2 DISPOSAL**

- A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.
- B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

**3.3 REPORT**

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.

- B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.
- C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

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**SECTION 02 41 00**  
**DEMOLITION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies demolition and removal of portions of buildings, utilities, and debris.

**1.2 RELATED WORK:**

- A. Safety Requirements: Section 01 35 26 Safety Requirements Article, ACCIDENT PREVENTION PLAN (APP).
- B. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- C. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.

**1.3 PROTECTION:**

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such spaces and utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.
- C. Maintain fences, barricades, lights, and other similar items around exposed excavations or openings until such have been completely filled or closed.
- D. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.
- E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not



limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.

- F. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items shall be repaired or replaced as approved by the Resident Engineer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have Resident Engineer's approval.
- G. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- H. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7 INFECTION PREVENTION MEASURES.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**3.1 DEMOLITION:**

- A. Completely demolish and remove portions of the buildings and structures, including all appurtenances related or connected thereto.
- B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him off the Medical Center property.
- C. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

**3.2 CLEAN-UP:**

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Resident Engineer. Clean-up shall include disposal of all items and materials not required to remain property of the Government as well as all debris and rubbish resulting from demolition operations.

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**SECTION 02 83 33.13**  
**LEAD-BASED PAINT REMOVAL AND DISPOSAL**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies abatement and disposal of lead-based paint (LBP) and controls needed to limit occupational and environmental exposure to lead hazards.

**1.2 RELATED WORK**

- A. Section 02 41 00, DEMOLITION.
- B. Section 09 91 00, PAINTING.

**1.3 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B. Code of Federal Regulations (CFR):
  - CFR 29 Part 1910.....Occupational Safety and Health Standards
  - CFR 29 Part 1926.....Safety and Health Regulations for Construction
  - CFR 40 Part 148.....Hazardous Waste Injection Restrictions
  - CFR 40 Part 260.....Hazardous Waste Management System: General
  - CFR 40 Part 261.....Identification and Listing of Hazardous Waste
  - CFR 40 Part 262.....Standards Applicable to Generators of Hazardous Waste
  - CFR 40 Part 263.....Standards Applicable to Transporters of Hazardous Waste
  - CFR 40 Part 264.....Standards for Owners and Operations of Hazardous Waste Treatment, Storage, and Disposal Facilities
  - CFR 40 Part 265.....Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
  - CFR 40 Part 268.....Land Disposal Restrictions
  - CFR 49 Part 172.....Hazardous Material Table, Special Provisions, Hazardous Material Communications, Emergency Response Information, and Training Requirements
  - CFR 49 Part 178.....Specifications for Packaging
- C. National Fire Protection Association (NFPA):
  - NFPA 701-2004.....Methods of Fire Test for Flame-Resistant Textiles and Films
- D. National Institute for Occupational Safety And Health (NIOSH)

- NIOSH OSHA Booklet 3142. Lead in Construction
- E. Underwriters Laboratories (UL)  
UL 586-1996 (Rev 2009).. High-Efficiency, Particulate, Air Filter  
Units
- F. American National Standards Institute  
Z9.2-2006.....Fundamentals Governing the Design and Operation  
of Local Exhaust Systems  
Z88.6-2006.....Respiratory Protection

**1.4 DEFINITIONS**

- A. Action Level: Employee exposure, without regard to use of respirations, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period. As used in this section, "30 micrograms per cubic meter of air" refers to the action level.
- B. Area Monitoring: Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations which may reach the breathing zone of personnel potentially exposed to lead.
- C. Physical Boundary: Area physically roped or partitioned off around an enclosed lead control area to limit unauthorized entry of personnel. As used in this section, "inside boundary" shall mean the same as "outside lead control area."
- D. Certified Industrial Hygienist (CIH): As used in this section, refers to an Industrial Hygienist employed by the Contractor and is certified by the American Board of Industrial Hygiene in comprehensive practice.
- E. Change Rooms and Shower Facilities: Rooms within the designated physical boundary around the lead control area equipped with separate storage facilities for clean protective work clothing and equipment and for street clothes which prevent cross- contamination.
- F. Competent Person: A person capable of identifying lead hazards in the work area and is authorized by the contractor to take corrective action.
- G. Decontamination Room: Room for removal of contaminated personal protective equipment (PPE).
- H. Eight-Hour Time Weighted Average (TWA): Airborne concentration of lead averaged over an 8-hour workday to which an employee is exposed.
- I. High Efficiency Particulate Air (HEPA) Filter Equipment: HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron size particles.

- J. Lead: Metallic lead, inorganic lead compounds, and organic lead soaps. Excluded from this definition are other organic lead compounds.
- K. Lead Control Area: An enclosed area or structure with full containment to prevent the spread of lead dust, paint chips, or debris of lead-containing paint removal operations. The lead control area is isolated by physical boundaries to prevent unauthorized entry of personnel.
- L. Lead Permissible Exposure Limit (PEL): Fifty micrograms per cubic meter of air as an 8-hour time weighted average as determined by 29 CFR 1910.1025. If an employee is exposed for more than 8 hours in a work day, the PEL shall be determined by the following formula. 
$$\text{PEL (micrograms/cubic meter of air)} = 400/\text{No. of hrs worked per day}$$
- M. Personnel Monitoring: Sampling of lead concentrations within the breathing zone of an employee to determine the 8-hour time weighted average concentration in accordance with 29 CFR 1910.1025. Samples shall be representative of the employee's work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of 150 mm to 225 mm (6 to 9 inches) and the center at the nose or mouth of an employee.

#### 1.5 QUALITY ASSURANCE

- A. Before exposure to lead-contaminated dust, provide workers with a comprehensive medical examination as required by 29 CFR 1926.62 (I) (1) (i) & (ii). The examination shall not be required if adequate records show that employees have been examined as required by 29 CFR 1926.62(I) without the last year.
- B. Medical Records: Maintain complete and accurate medical records of employees in accordance with 29 CFR 1910.20.
- C. CIH Responsibilities: The Contractor shall employ a certified Industrial Hygienist who will be responsible for the following:
  - 1. Certify Training.
  - 2. Review and approve lead-containing paint removal plan for conformance to the applicable referenced standards.
  - 3. Inspect lead-containing paint removal work for conformance with the approved plan.
  - 4. Direct monitoring.
  - 5. Ensure work is performed in strict accordance with specifications at all times.
  - 6. Ensure hazardous exposure to personnel and to the environment are adequately controlled at all times.

- D. Training: Train each employee performing paint removal, disposal, and air sampling operations prior to the time of initial job assignment, in accordance with 29 CFR 1926.62.
- E. Training Certification: Submit certificates signed and dated by the CIH and by each employee stating that the employee has received training.
- F. Respiratory Protection Program:
  - 1. Furnish each employee required to wear a negative pressure respirator or other appropriate type with a respirator fit test at the time of initial fitting and at least every 6 months thereafter as required by 29 CFR 1926.62.
  - 2. Establish and implement a respiratory protection program as required by 29 CFR 1910.134, 29 CFR 1910.1025, and 29 CFR 1926.62.
- G. Hazard Communication Program: Establish and implement a Hazard Communication Program as required by 29 CFR 1910.1200.
- H. Hazardous Waste Management: The Hazardous Waste Management plan shall comply with applicable requirements of Federal, State, and local hazardous waste regulations and address:
  - 1. Identification of hazardous wastes associated with the work.
  - 2. Estimated quantities of wastes to be generated and disposed of.
  - 3. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and a 24-hour point of contact. Furnish two copies of the hazardous waste permit applications and permits
  - 4. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.
  - 5. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
  - 6. Spill prevention, containment, and cleanup contingency measures to be implemented.
  - 7. Work plan and schedule for waste containment, removal and disposal. Wastes shall be cleaned up and containerized daily.
  - 8. Cost for hazardous waste disposal according to this plan.
- I. Safety and Health Compliance:
  - 1. In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, state, and local authorities regarding removing, handling, storing, transporting, and disposing of lead waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1910.1025.

Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work.

2. Where specification requirements and the referenced documents vary, the most stringent requirements shall apply.
- J. Pre-Construction Conference: Along with the CIH, meet with the Contracting Officer to discuss in detail the lead-containing paint removal work plan, including work procedures and precautions for the work plan.

#### **1.6 SUBMITTALS**

- A. Submit the following in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Catalog Data:  
Vacuum filters  
Respirators
- C. Instructions: Paint removal materials. Include applicable material safety data sheets.
- D. Statements Certifications and Statements:
  1. Qualifications of CIH: Submit name, address, and telephone number of the CIH selected to perform responsibilities in paragraph entitled "CIH Responsibilities." Provide previous experience of the CIH. Submit proper documentation that the Industrial Hygienist is certified by the American Board of Industrial Hygiene in comprehensive practice, including certification number and date of certification/recertification.
  2. Testing Laboratory: Submit the name, address, and telephone number of the testing laboratory selected to perform the monitoring, testing, and reporting of airborne concentrations of lead. Provide proper documentation that persons performing the analysis have been judged proficient by successful participation within the last year in the National Institute for Occupational Safety and Health (NIOSH) Proficiency Analytical Testing (PAT) Program. The laboratory shall be accredited by the American Industrial Hygiene Association (AIHA). Provide AIHA documentation along with date of accreditation/reaccreditation.
  3. Lead-Containing Paint Removal Plan:
    - a. Submit a detailed job-specific plan of the work procedures to be used in the removal of lead-containing paint. The plan shall include a sketch showing the location, size, and details of lead control areas, location and details of decontamination rooms,

change rooms, shower facilities, and mechanical ventilation system.

- b. Include in the plan, eating, drinking, smoking and restroom procedures, interface of trades, sequencing of lead related work, collected wastewater and paint debris disposal plan, air sampling plan, respirators, protective equipment, and a detailed description of the method of containment of the operation to ensure that airborne lead concentrations of 30 micrograms per cubic meter of air are not exceeded outside of the lead control area.
  - c. Include air sampling, training and strategy, sampling methodology, frequency, duration of sampling, and qualifications of air monitoring personnel in the air sampling portion on the plan.
4. Field Test Reports: Monitoring Results: Submit monitoring results to the Contracting Officer within 3 working days, signed by the testing laboratory employee performing the air monitoring, the employee that analyzed the sample, and the CIH.
  5. Records:
    - a. Completed and signed hazardous waste manifest from treatment or disposal facility.
    - b. Certification of Medical Examinations.
    - c. Employee training certification.

## **PART 2 PRODUCTS**

**PAINT REMOVAL PRODUCTS:** Submit applicable Material Safety Data Sheets for paint removal products used in paint removal work. Use the least toxic product, suitable for the job and acceptable to the Industrial Hygienist.

## **PART 3 EXECUTION**

### **3.1 PROTECTION**

- A. Notification: Notify the Contracting Officer 20 days prior to the start of any paint removal work.
- B. Lead Control Area Requirements.
  1. Establish a lead control area by completely enclosing with containment screens the area or structure where lead-containing paint removal operations will be performed.
  2. Contain removal operations by the use of a negative pressure full containment system with at least one change room and with HEPA filtered exhaust.



- C. Protection of Existing Work to Remain: Perform paint removal work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition.
- D. Boundary Requirements: Provide physical boundaries around the lead control area by roping off the area [designated on the drawings] or providing curtains, portable partitions or other enclosures to ensure that airborne concentrations of lead will not reach 30 micrograms per cubic meter of air outside of the lead control area.
- E. Heating, Ventilating and Air Conditioning (HVAC) Systems: Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass through the lead control areas. Seal intake and exhaust vents in the lead control area with 6-mil plastic sheet and tape. Seal seams in HVAC components that pass through the lead control area.
- F. Change Room and Shower Facilities: Provide clean change rooms and shower facilities within the physical boundary around the designated lead control area in accordance with requirements of 29 CFR 1926.62.
- G. Mechanical Ventilation System:
  - 1. Use adequate ventilation to control personnel exposure to lead in accordance with 29 CFR 1926.57.
  - 2. To the extent feasible, use fixed local exhaust ventilation connected to HEPA filters or other collection systems, approved by the industrial hygienist. Local exhaust ventilation systems shall be designed, constructed, installed, and maintained in accordance with ANSI Z9.2.
  - 3. If air from exhaust ventilation is recirculated into the work place, the system shall have a high efficiency filter with reliable back-up filter and controls to monitor the concentration of lead in the return air and to bypass the recirculation system automatically if it fails. Air may be recirculated only where exhaust to the outside is not feasible.
- H. Personnel Protection: Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been given appropriate training and protective equipment.
- I. Warning Signs: Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.

### 3.2 WORK PROCEDURES

- A. Perform removal of lead-containing paint in accordance with approved lead-containing paint removal plan. Use procedures and equipment required to limit occupational and environmental exposure to lead when lead-containing paint is removed in accordance with 29 CFR 1926.62, except as specified herein. Dispose of removed paint chips and associated waste in compliance with Environmental Protection Agency (EPA), federal, state, and local requirements.
- B. Personnel Exiting Procedures:
  - 1. Whenever personnel exist the lead-controlled area, they shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn during the work day:
    - a. Vacuum themselves off.
    - b. Remove protective clothing in the decontamination room, and place them in an approved impermeable disposal bag.
    - c. Shower.
    - d. Change to clean clothes prior to leaving the physical boundary designated around the lead-contaminated job site.
- C. Monitoring: Monitoring of airborne concentrations of lead shall be in accordance with 29 CFR 1910.1025 and as specified herein. Air monitoring, testing, and reporting shall be performed by a CIH or an Industrial Hygiene (IH) Technician who is under the direction of the CIH:
  - 1. The CIH or the IH Technician under the direction of the CIH shall be on the job site directing the monitoring, and inspecting the lead-containing paint removal work to ensure that the requirements of the Contract have been satisfied during the entire lead-containing paint removal operation.
  - 2. Take personal air monitoring samples on employees who are anticipated to have the greatest risk of exposure as determined by the CIH. In addition, take air monitoring samples on at least 25 percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.
  - 3. Submit results of air monitoring samples, signed by the CIH, within 24 hours after the air samples are taken. Notify the Contracting Officer immediately of exposure to lead at or in excess of the action level of 30 micrograms per cubic meter of air outside of the lead control area.
- D. Monitoring During Paint Removal Work:

1. Perform personal and area monitoring during the entire paint removal operation. Sufficient area monitoring shall be conducted at the physical boundary to ensure unprotected personnel are not exposed above 30 micrograms per cubic meter of air at all times. If the outside boundary lead levels are at or exceed 30 micrograms per cubic meter of air, work shall be stopped and the CIH shall immediately correct the condition(s) causing the increased levels and notify the Contracting Officer immediately.
2. The CIH shall review the sampling data collected on that day to determine if condition(s) requires any further change in work methods. Removal work shall resume when approval is given by the CIH. The Contractor shall control the lead level outside of the work boundary to less than 30 micrograms per cubic meter of air at all times. As a minimum, conduct area monitoring daily on each shift in which lead paint removal operations are performed in areas immediately adjacent to the lead control area.
3. For outdoor operations, at least one sample on each shift shall be taken on the downwind side of the lead control area. If adjacent areas are contaminated, clean and visually inspect contaminated areas. The CIH shall certify that the area has been cleaned of lead contamination.

### **3.3 LEAD-CONTAINING PAINT REMOVAL**

- A. Remove paint within the areas designated on the drawings in order to completely expose the substrate. Take whatever precautions are necessary to minimize damage to the underlying substrate.
- B. Indoor Lead Paint Removal: Select paint removal processes to minimize contamination of work areas with lead-contaminated dust or other lead-contaminated debris/waste. This paint removal process should be described in the lead-containing paint removal plan. Perform manual sanding and scraping to the maximum extent feasible.
- C. Mechanical Paint Removal and Blast Cleaning: Perform mechanical paint removal and blast cleaning in lead control areas using negative pressure full containments with HEPA filtered exhaust. Collect paint residue and spent grit (used abrasive) from blasting operations for disposal in accordance with EPA, state and local requirements.
- D. Outside Lead Paint Removal: Select removal processes to minimize contamination of work areas with lead-contaminated dust or other lead-contaminated debris/waste. This paint removal process should be

described in the lead-containing paint removal plan. Perform manual sanding and scraping to the maximum extent feasible.

### **3.4 SURFACE PREPARATIONS**

Avoid flash rusting or other deterioration of the substrate. Provide surface preparations for painting in accordance with Section 09 91 00, PAINTING.

### **3.5 CLEANUP AND DISPOSAL**

- A. Cleanup: Maintain surfaces of the lead control area free of accumulations of paint chips and dust. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use compressed air to clean up the area. At the end of each shift and when the paint removal operation has been completed, clean the area of visible lead paint contamination by vacuuming with a HEPA filtered vacuum cleaner and wet mopping the area.
- B. Certification: The CIH shall certify in writing that the inside and outside the lead control area air monitoring samples are less than 30 micrograms per cubic meter of air, the respiratory protection for the employees was adequate, the work procedures were performed in accordance with 29 CFR 1926.62, and that there were no visible accumulations of lead-contaminated paint and dust on the worksite. Do not remove the lead control area or roped-off boundary and warning signs prior to the Contracting Officer's receipt of the CIH's certification. Reclean areas showing dust or residual paint chips.
- C. Testing of Lead-Containing Paint Residue and Used Abrasive Where indicated or when directed by the Contracting Officer, test lead containing paint residue and used abrasive in accordance with 40 CFR 261 for hazardous waste.
- D. Disposal:
  - 1. Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing, which may produce airborne concentrations of lead particles.
  - 2. Store removed paint, lead-contaminated clothing and equipment, and lead-contaminated dust and cleaning debris into U.S. Department of Transportation (49 CFR 178) approved 55-gallon drums. Properly labels each drum to identify the type of waste (49 CFR 172) and the date lead-contaminated wastes were first put into the drum. Comply with land disposal restriction notification requirements as required by 40 CFR 268:

- a. At least 14 days prior to delivery, notify the Contracting Officer who will arrange for job site inspection of the drums and manifests by [PWC Hazardous Waste Storage Facility personnel]
  - b. As necessary, make lot deliveries of hazardous wastes to the PWC Hazardous Waste Storage Facility to ensure that drums do not remain on the jobsite longer than 90 calendar days from the date affixed to each drum.
  - a. Collect all hazardous contaminated material waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing which may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1926.62. Dispose of contaminated waste material in accordance with all applicable laws and regulations at an approved hazardous waste treatment, storage, or disposal facility off Government property.
  - b. Store waste materials in U.S. Department of Transportation (49 CFR 178) approved 55-gallon drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. The Contracting Officer or an authorized representative will assign an area for interim storage of waste-containing drums.  
Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.
  - c. Handle, store, transport, and dispose lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.
- E. Disposal Documentation Submit written evidence that the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA and state or local regulatory agencies. Submit one copy of the completed manifest, signed and dated by the initial transporter in accordance with 40 CFR 262.

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**SECTION 02 82 13.31  
ASBESTOS ELEVATOR DOOR ABATEMENT**

**PART 1 - GENERAL**

**1.1 SUMMARY OF THE WORK**

**1.1.1 CONTRACT DOCUMENTS AND RELATED REQUIREMENTS**

Drawings, general provisions of the contract, including general and supplementary conditions and other Division 01 specifications, shall apply to the work of this section. The contract documents show the work to be done under the contract and related requirements and conditions impacting the project. Related requirements and conditions include applicable codes and regulations, notices and permits, existing site conditions and restrictions on use of the site, requirements for partial owner occupancy during the work, coordination with other work and the phasing of the work. In the event the Asbestos Abatement Contractor discovers a conflict in the contract documents and/or requirements or codes, the conflict must be brought to the immediate attention of the Contracting Officer for resolution. Whenever there is a conflict or overlap in the requirements, the most stringent shall apply. Any actions taken by the Contractor without obtaining guidance from the Contracting Officer shall become the sole risk and responsibility of the Asbestos Abatement Contractor. All costs incurred.

**1.1.2 EXTENT OF WORK**

- A. Below is a brief description of the estimated quantities of asbestos elevator doors to be removed and disposed of. These quantities are for informational purposes only and are based on the best information available at the time of the specification preparation. The Contractor shall satisfy himself as the actual quantities to be removed and disposed of. Nothing in this section may be interpreted as limiting the extent of work otherwise required by this contract and related documents.
- B. Removal, and disposal of ACM elevator doors in the following approximate quantities;

( 12 ) sets of elevator doors (2 each)

**1.1.3 RELATED WORK**

- A. Section 07 84 00, FIRESTOPPING.
- B. Section 02 41 00, DEMOLITION.
- C. Division 09, FINISHES.

**1.1.4 TASKS**

The work tasks are summarized briefly as follows:

- A. Pre-abatement activities including pre-abatement meeting(s), inspection(s), notifications, permits, submittal approvals, regulated area preparations, emergency procedures arrangements, and standard operating procedures for asbestos abatement work.
- B. Abatement activities including removal, and disposal of ACM elevator doors, recordkeeping, security, monitoring, and inspections.
- C. Final visual inspection and certification. of completion

#### 1.1.5 ABATEMENT CONTRACTOR USE OF PREMISES

- A. The Contractor and Contractor's personnel shall cooperate fully with the VA representative/consultant to facilitate efficient use of buildings and areas within buildings. The Contractor shall perform the work in accordance with the VA specifications, drawings, phasing plan and in compliance with any/all applicable Federal, State and Local regulations and requirements.
- B. The Contractor shall use the existing facilities in the building strictly within the limits indicated in contract documents as well as the approved VA Design and Construction Procedure.

#### 1.2 VARIATIONS IN QUANTITY

The quantities and locations of ACM as indicated on the drawings and the extent of work included in this section are estimated which are limited by the physical constraints imposed by occupancy of the buildings and accessibility to ACM. Accordingly, minor variations (+/- 5%) in quantities of ACM within the regulated area are considered as having no impact on contract price and time requirements of this contract. Where additional work is required beyond the above variation, the contractor shall provide unit prices for newly discovered ACM and those prices shall be used for additional work required under the contract.

#### 1.3 STOP ASBESTOS REMOVAL

If the Contracting Officer; their field representative; (the facility Safety Officer/Manager or their designee, or the VA Professional Industrial Hygienist//Certified Industrial Hygienist (VPIH/CIH) presents a verbal **Stop Asbestos Removal Order**, the Contractor/Personnel shall immediately stop all asbestos removal. If a verbal Stop Asbestos Removal Order is issued, the VA shall follow-up with a written order to the Contractor as soon as practicable. The Contractor shall not resume any asbestos removal activity until authorized to do so in writing by the VA Contracting Officer. A stop asbestos removal order may be issued at any time the VA Contracting Officer determines abatement conditions/activities are not within VA specification, regulatory requirements or that an imminent hazard exists to human health or the environment. Work stoppage will continue until conditions have been corrected to the satisfaction of the VA. Standby time and costs for corrective actions will be borne by the Contractor, including the VPIH/CIH time. The occurrence of any of the following events shall be reported immediately by the Contractor's competent person to the VA Contracting Office or field representative using the most expeditious means (e.g., verbal or telephonic), followed up with written notification to the Contracting Officer as soon as it is practical. The Contractor shall immediately stop asbestos removal/disturbance activities:

- A. serious injury/death at the site ;
- B. fire/safety emergency at the site ;
- C. power failure or loss of wetting agent; or

## 1.4 DEFINITIONS

### 1.4.1 GENERAL

Definitions and explanations here are neither complete nor exclusive of all terms used in the contract documents, but are general for the work to the extent they are not stated more explicitly in another element of the contract documents. Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated therein.

### 1.4.2 GLOSSARY

**Abatement** - Procedures to control fiber release from asbestos-containing materials. Includes removal, encapsulation, enclosure, demolition and renovation activities related to asbestos containing materials (ACM).

**Aerosol** - Solid or liquid particulate suspended in air.

**Adequately wet** - Sufficiently mixed or penetrated with liquid to prevent the release of particulates. If visible emissions are observed coming from the ACM, then that material has not been adequately wetted.

**Aggressive method** - Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact ACM.

**Aggressive sampling** - EPA AHERA defined clearance sampling method using air moving equipment such as fans and leaf blowers to aggressively disturb and maintain in the air residual fibers after abatement.

**AHERA** - Asbestos Hazard Emergency Response Act. Asbestos regulations for schools issued in 1987.

**Aircell** - Pipe or duct insulation made of corrugated cardboard which contains asbestos.

**Air monitoring** - The process of measuring the fiber content of a known volume of air collected over a specified period of time. The NIOSH 7400 Method, Issue 2 is used to determine the fiber levels in air. For personal samples and clearance air testing using Phase Contrast Microscopy (PCM) analysis. NIOSH Method 7402 can be used when it is necessary to confirm fibers counted by PCM as being asbestos. The AHERA TEM analysis may be used for background, area samples and clearance samples when required by this specification, or at the discretion of the VPIH/CIH as appropriate.

**Air sample filter** - The filter used to collect fibers which are then counted. The filter is made of mixed cellulose ester membrane for PCM (Phase Contrast Microscopy) and polycarbonate for TEM (Transmission Electron Microscopy)

**Amended water** - Water to which a surfactant (wetting agent) has been added to increase the penetrating ability of the liquid.

**Asbestos** - Includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated or altered. Asbestos also includes PACM, as defined below.

**Asbestos Hazard Abatement Plan (AHAP)** - Asbestos work procedures required to be submitted by the contractor before work begins.

**Asbestos-containing material (ACM)** - Any material containing more than one percent of asbestos.

**Asbestos contaminated elements (ACE)** - Building elements such as ceilings, walls, lights, or ductwork that are contaminated with asbestos.



**Asbestos-contaminated soil (ACS)** - Soil found in the work area or in adjacent areas such as crawlspaces or pipe tunnels which is contaminated with asbestos-containing material debris and cannot be easily separated from the material.

**Asbestos-containing waste (ACW) material** - Asbestos-containing material or asbestos contaminated objects requiring disposal.

**Asbestos Project Monitor** - Some states require that any person conducting asbestos abatement clearance inspections and clearance air sampling be licensed as an asbestos project monitor.

**Asbestos waste decontamination facility** - A system consisting of drum/bag washing facilities and a temporary storage area for cleaned containers of asbestos waste. Used as the exit for waste and equipment leaving the regulated area. In an emergency, it may be used to evacuate personnel.

**Authorized person** - Any person authorized by the VA, the Contractor, or government agency and required by work duties to be present in regulated areas.

**Authorized visitor** - Any person approved by the VA; the contractor; or any government agency representative having jurisdiction over the regulated area (e.g., OSHA, Federal and State EPA).

**Barrier** - Any surface that isolates the regulated area and inhibits fiber migration from the regulated area.

**Containment Barrier** - An airtight barrier consisting of walls, floors, and/or ceilings of sealed plastic sheeting which surrounds and seals the outer perimeter of the regulated area.

**Critical Barrier** - The barrier responsible for isolating the regulated area from adjacent spaces, typically constructed of plastic sheeting secured in place at openings such as doors, windows, or any other opening into the regulated area.

**Primary Barrier** - Plastic barriers placed over critical barriers and exposed directly to abatement work.

**Secondary Barrier** - Any additional plastic barriers used to isolate and provide protection from debris during abatement work.

**Breathing zone** - The hemisphere forward of the shoulders with a radius of about 150 - 225 mm (6 - 9 inches) from the worker's nose.

**Bridging encapsulant** - An encapsulant that forms a layer on the surface of the ACM.

**Building/facility owner** - The legal entity, including a lessee, which exercises control over management and recordkeeping functions relating to a building and/or facility in which asbestos activities take place.

**Bulk testing** - The collection and analysis of suspect asbestos containing materials.

**Certified Industrial Hygienist (CIH)** - A person certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene.

**Class I asbestos work** - Activities involving the removal of Thermal System Insulation (TSI) and surfacing ACM and Presumed Asbestos Containing Material (PACM).

**Class II asbestos work** - Activities involving the removal of ACM which is not thermal system insulation 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 mastic.

**Clean room/Changing room** - An uncontaminated room having facilities for the storage of employee's street clothing and uncontaminated materials and equipment.

**Clearance sample** - The final air sample taken after all asbestos work has been done and visually inspected. Performed by the VA's professional industrial hygiene consultant/Certified Industrial Hygienist (VPIH/CIH).

**Closely resemble** - The major workplace conditions which have contributed to the levels of historic asbestos exposure, are no more protective than conditions of the current workplace.

**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, for Class I and II work who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor.

**Contractor's Professional Industrial Hygienist (CPIH/CIH)** - The asbestos abatement contractor's industrial hygienist. The industrial hygienist must meet the qualification requirements of a PIH and may be a certified industrial hygienist (CIH).

**Count** - Refers to the fiber count or the average number of fibers greater than five microns in length with a length-to-width (aspect) ratio of at least 3 to 1, per cubic centimeter of air.

**Crawlspace** - An area which can be found either in or adjacent to the work area. This area has limited access and egress and may contain asbestos materials and/or asbestos contaminated soil.

**Decontamination area/unit** - An enclosed area adjacent to and connected to the regulated area and consisting of an equipment room, shower room, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

**Demolition** - The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.

**VA Total** - means a building or substantial part of the building is completely removed, torn or knocked down, bulldozed, flattened, or razed, including removal of building debris.

**Disposal bag** - Typically 6 mil thick sift-proof, dustproof, leak-tight container used to package and transport asbestos waste from regulated areas to the approved landfill. Each bag/container must be labeled/marked in accordance with EPA, OSHA and DOT requirements.

**Disturbance** - Activities that disrupt the matrix of ACM or PACM, crumble or pulverize ACM or PACM, or generate visible debris from ACM or PACM. Disturbance includes cutting away small amounts of ACM or PACM, no greater than the amount that can be contained in one standard sized glove bag 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 disposal bag which shall not exceed 60 inches in length or width.

**Drum** - A rigid, impermeable container made of cardboard fiber, plastic, or metal which can be sealed in order to be sift-proof, dustproof, and leak-tight.

**Employee exposure** - The exposure to airborne asbestos that would occur if the employee were not wearing respiratory protection equipment.

**Encapsulant** - A material that surrounds or embeds asbestos fibers in an adhesive matrix and prevents the release of fibers.

**Encapsulation** - Treating ACM with an encapsulant.

**Enclosure** - The construction of an air tight, impermeable, permanent barrier around ACM to control the release of asbestos fibers from the material and also eliminate access to the material.

**Equipment room** - A contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

**Fiber** - A particulate form of asbestos, 5 microns or longer, with a length to width (aspect) ratio of at least 3 to 1.

**Fibers per cubic centimeter (f/cc)** - Abbreviation for fibers per cubic centimeter, used to describe the level of asbestos fibers in air.

**Filter** - Media used in respirators, vacuums, or other machines to remove particulate from air.

**Firestopping** - Material used to close the open parts of a structure in order to prevent a fire from spreading.

**Friable asbestos containing material** - Any material containing more than one (1) percent or asbestos as determined using the method specified in appendix A, Subpart F, 40 CFR 763, section 1, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

**Glovebag** - Not more than a 60"x60" impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which materials and tools may be handled.

**High efficiency particulate air (HEPA) filter** - An ASHRAE MERV 17 filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.

**HEPA vacuum** - Vacuum collection equipment equipped with a HEPA filter system capable of collecting and retaining asbestos fibers.

**Homogeneous area** - An area of surfacing, thermal system insulation or miscellaneous ACM that is uniform in color, texture and date of application.

**HVAC** - Heating, Ventilation and Air Conditioning

**Industrial hygienist (IH)** - A professional qualified by education, training, and experience to anticipate, recognize, evaluate, and develop controls for occupational health hazards. Meets definition requirements of the American Industrial Hygiene Association (AIHA).

**Industrial hygienist technician (IH Technician)** - A person working under the direction of an IH or CIH who has special training, experience, certifications and licenses required for the industrial hygiene work assigned. Some states require that an industrial hygienist technician conducting asbestos abatement clearance inspection and clearance air sampling be licensed as an asbestos project monitor.

**Intact** - The ACM has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix.

**Lockdown** - Applying encapsulant, after a final visual inspection, on all abated surfaces at the conclusion of ACM removal prior to removal of critical barriers.

**National Emission Standards for Hazardous Air Pollutants (NESHAP)** - EPA's rule to control emissions of asbestos to the environment (40 CFR part 61, Subpart M).

**Negative initial exposure assessment** - A demonstration by the employer which complies with the criteria in 29 CFR 1926.1101 (f)(2)(iii), that employee exposure during an operation is expected to be consistently below the PEL's.

**Negative pressure** - Air pressure which is lower than the surrounding area, created by exhausting air from a sealed regulated area through

HEPA equipped filtration units. OSHA requires maintaining -0.02" water column gauge inside the negative pressure enclosure.

**Negative pressure respirator** - A respirator in which the air pressure inside the facepiece is negative during inhalation relative to the air pressure outside the respirator facepiece.

**Non-friable ACM** - Material that contains more than 1 percent asbestos but cannot be crumbled, pulverized, or reduced to powder by hand pressure.

**Organic vapor cartridge** - The type of cartridge used on air purifying respirators to remove organic vapor hazardous air contaminants.

**Outside air** - The air outside buildings and structures, including, but not limited to, the air under a bridge or in an open ferry dock.

**Owner/operator** - Any person who owns, leases, operates, controls, or supervises the facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operation, or both.

**Penetrating encapsulant** - Encapsulant that is absorbed into the ACM matrix without leaving a surface layer.

**Personal protective equipment (PPE)** - equipment designed to protect user from injury and/or specific job hazard. Such equipment may include protective clothing, hard hats, safety glasses, and respirators.

**Personal sampling/monitoring** - Representative air samples obtained in the breathing zone for one or workers within the regulated area using a filter cassette and a calibrated air sampling pump to determine asbestos exposure.

**Permissible exposure limit (PEL)** - The level of exposure OSHA allows for an 8-hour time weighted average. For asbestos fibers, the eight (8) hour time weighted average PEL is 0.1 fibers per cubic centimeter (0.1 f/cc) of air and the 30-minute Excursion Limit is 1.0 fibers per cubic centimeter (1 f/cc).

**Pipe tunnel** - An area, typically located adjacent to mechanical spaces or boiler rooms in which the pipes servicing the heating system in the building are routed to allow the pipes to access heating elements. These areas may contain asbestos pipe insulation, asbestos fittings, or asbestos-contaminated soil.

**Polarized light microscopy (PLM)** - Light microscopy using dispersion staining techniques and refractive indices to identify and quantify the type(s) of asbestos present in a bulk sample.

**Polyethylene sheeting** - Strong plastic barrier material 4 to 6 mils thick, semi-transparent, flame retardant per NFPA 241.

**Positive/negative fit check** - A method of verifying the seal of a facepiece respirator by temporarily occluding the filters and breathing in (inhaling) and then temporarily occluding the exhalation valve and breathing out (exhaling) while checking for inward or outward leakage of the respirator respectively.

**Presumed ACM (PACM)** - Thermal system insulation, surfacing, and flooring material installed in buildings prior to 1981. If the building owner has actual knowledge, or should have known through the exercise of due diligence that other materials are ACM, they too must be treated as PACM. The designation of PACM may be rebutted pursuant to 29 CFR 1926.1101 (b).

**Professional IH** - An IH who meets the definition requirements of AIHA; meets the definition requirements of OSHA as a "Competent Person" at 29 CFR 1926.1101 (b); has completed two specialized EPA approved courses on management and supervision of asbestos abatement projects; has

formal training in respiratory protection and waste disposal; and has a minimum of four projects of similar complexity with this project of which at least three projects serving as the supervisory IH. The PIH may be either the VA's PIH (VPIH) of Contractor's PIH (CPIH/CIH).

**Project designer** - A person who has successfully completed the training requirements for an asbestos abatement project designer as required by 40 CFR 763 Appendix C, Part I; (B)(5).

**Assigned Protection factor** - A value assigned by OSHA/NIOSH to indicate the expected protection by each respirator class, when the respirator is properly selected and worn correctly. The number indicates the reduction of exposure level from outside to inside the respirator facepiece.

**Qualitative fit test (QLFT)** - A fit test using a challenge material that can be sensed by the wearer if leakage in the respirator occurs.

**Quantitative fit test (QNFT)** - A fit test using a challenge material which is quantified outside and inside the respirator thus allowing the determination of the actual fit factor.

**Regulated area** - An area established by the employer to demarcate where Class I, II, III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work may accumulate; and a work area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed the PEL.

**Regulated ACM (RACM)** - Friable ACM; Category I non-friable ACM that has become friable; Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or; Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of the demolition or renovation operation.

**Removal** - All operations where ACM, PACM and/or RACM is taken out or stripped from structures or substrates, including demolition operations.

**Renovation** - Altering a facility or one or more facility components in any way, including the stripping or removal of asbestos from a facility component which does not involve demolition activity.

**Repair** - Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM or PACM attached to structures or substrates.

**Shower room** - The portion of the PDF where personnel shower before leaving the regulated area.

**Supplied air respirator (SAR)** - A respiratory protection system that supplies minimum Grade D respirable air per ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989.

**Surfacing ACM** - A material containing more than 1 percent asbestos that is sprayed, troweled on or otherwise applied to surfaces for acoustical, fireproofing and other purposes.

**Surfactant** - A chemical added to water to decrease water's surface tension thus making it more penetrating into ACM.

**Thermal system ACM** - A material containing more than 1 percent asbestos applied to pipes, fittings, boilers, breeching, tanks, ducts, or other structural components to prevent heat loss or gain.

**Transmission electron microscopy (TEM)** - A microscopy method that can identify and count asbestos fibers.

**VA Professional Industrial Hygienist (VPIH/CIH)** - The Department of Veterans Affairs Professional Industrial Hygienist must meet the

qualifications of a PIH, and may be a Certified Industrial Hygienist (CIH).

**VA Representative** - The VA official responsible for on-going project work.

**Visible emissions** - Any emissions, which are visually detectable without the aid of instruments, coming from ACM/PACM/RACM/ACS or ACM waste material.

**Waste/Equipment decontamination facility (W/EDF)** - The area in which equipment is decontaminated before removal from the regulated area.

**Waste generator** - Any owner or operator whose act or process produces asbestos-containing waste material.

**Waste shipment record** - The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos-containing waste material.

**Wet cleaning** - The process of thoroughly eliminating, by wet methods, any asbestos contamination from surfaces or objects.

#### 1.4.3 REFERENCED STANDARDS ORGANIZATIONS

The following acronyms or abbreviations as referenced in contract/specification documents are defined to mean the associated names. Names and addresses may be subject to change.

- A. VA Department of Veterans Affairs  
810 Vermont Avenue, NW  
Washington, DC 20420
  
- B. AIHA American Industrial Hygiene Association  
2700 Prosperity Avenue, Suite 250  
Fairfax, VA 22031  
703-849-8888
  
- C. ANSI American National Standards Institute  
1430 Broadway  
New York, NY 10018  
212-354-3300
  
- D. ASTM American Society for Testing and Materials  
1916 Race St.  
Philadelphia, PA 19103  
215-299-5400
  
- E. CFR Code of Federal Regulations  
Government Printing Office  
Washington, DC 20420
  
- F. CGA Compressed Gas Association  
1235 Jefferson Davis Highway  
Arlington, VA 22202  
703-979-0900
  
- F. CS Commercial Standard of the National Institute of Standards and Technology (NIST)  
U. S. Department of Commerce  
Government Printing Office  
Washington, DC 20420

- G. EPA Environmental Protection Agency  
401 M St., SW  
Washington, DC 20460  
202-382-3949
- H. MIL-STD Military Standards/Standardization Division  
Office of the Assistant Secretary of Defense  
Washington, DC 20420
- J. NIST National Institute for Standards and Technology  
U. S. Department of Commerce  
Gaithersburg, MD 20234  
301-921-1000
- K. NEC National Electrical Code (by NFPA)
- L. NEMA National Electrical Manufacturer's Association  
2101 L Street, NW  
Washington, DC 20037
- M. NFPA National Fire Protection Association  
1 Batterymarch Park  
P.O. Box 9101  
Quincy, MA 02269-9101  
800-344-3555
- N. NIOSH National Institutes for Occupational Safety and Health  
4676 Columbia Parkway  
Cincinnati, OH 45226  
513-533-8236
- O. OSHA Occupational Safety and Health Administration  
U.S. Department of Labor  
Government Printing Office  
Washington, DC 20402
- P. UL Underwriters Laboratory  
333 Pfingsten Rd.  
Northbrook, IL 60062  
312-272-8800

## **1.5 APPLICABLE CODES AND REGULATIONS**

### **1.5.1 GENERAL APPLICABILITY OF CODES, REGULATIONS, AND STANDARDS**

- A. All work under this contract shall be done in strict accordance with all applicable Federal, State, and local regulations, standards and codes governing asbestos abatement, and any other trade work done in conjunction with the abatement. All applicable codes, regulations and standards are adopted into this specification and will have the same force and effect as this specification.
- B. The most recent edition of any relevant regulation, standard, document or code shall be in effect. Where conflict among the requirements or with these specifications exists, the most stringent requirement(s) shall be utilized.

- C. Copies of all standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 shall be available at the worksite in the clean change area of the worker decontamination system.

#### **1.5.2 CONTRACTOR RESPONSIBILITY**

The Asbestos Abatement Contractor (Contractor) shall assume full responsibility and liability for compliance with all applicable Federal, State and Local regulations related to any and all aspects of the asbestos abatement project. The Contractor is responsible for providing and maintaining training, accreditations, medical exams, medical records, personal protective equipment (PPE) including respiratory protection including respirator fit testing, as required by applicable Federal, State and Local regulations. The Contractor shall hold the VA and VPIH/CIH consultants harmless for any Contractor's failure to comply with any applicable work, packaging, transporting, disposal, safety, health, or environmental requirement on the part of himself, his employees, or his subcontractors.

#### **1.5.3 FEDERAL REQUIREMENTS**

Federal requirements which govern some aspect of asbestos abatement include, but are not limited to, the following regulations.

- A. Occupational Safety and Health Administration (OSHA)
1. Title 29 CFR 1926.1101 - Construction Standard for Asbestos
  2. Title 29 CFR 1910 Subpart I - Personal Protective Equipment
  3. Title 29 CFR 1910.134 - Respiratory Protection
  4. Title 29 CFR 1926 - Construction Industry Standards
  5. Title 29 CFR 1910.1020 - Access to Employee Exposure and Medical Records
  6. Title 29 CFR 1910.1020 - Hazard Communication
  7. Title 29 CFR 1910 Subpart K - Medical and First Aid
- B. Environmental Protection Agency (EPA)
1. 40 CFR 61 Subpart A and M (Revised Subpart B) - National Emission Standard for Hazardous Air Pollutants - Asbestos.
  2. 40 CFR 763.80 - Asbestos Hazard Emergency Response Act (AHERA)
- C. Department of Transportation (DOT)
- Title 49 CFR 100 - 185 - Transportation

#### **1.5.4 STATE REQUIREMENTS**

State requirements that apply to the asbestos abatement work, disposal, clearance, etc., include, but are not limited to, the following:

1. Missouri 10CSR10-6.241 - Asbestos Projects: Registration, Notification and Performance Requirements.
2. Missouri 10CSR10-6.250 - Asbestos Projects: Certification, Accreditations and Business Exemption Requirements.

#### **1.5.5 LOCAL REQUIREMENTS**

If local requirements are more stringent than federal or state standards, the local standards are to be followed.



1. City of St. Louis, Division of Air Pollution Control Rules and Regulations.

#### **1.5.6 STANDARDS**

- A. Standards which govern asbestos abatement activities include, but are not limited to, the following:
  1. American National Standards Institute (ANSI) Z9.2-79 - Fundamentals Governing the Design and Operation of Local Exhaust Systems Z88.2 - Practices for Respiratory Protection.
  2. Underwriters Laboratories (UL)586-90 - UL Standard for Safety of HEPA filter Units, 7th Edition.
- B. Standards which govern encapsulation work include, but are not limited to, the following:
  1. American Society for Testing and Materials (ASTM)
- C. Standards which govern the fire and safety concerns in abatement work include, but are not limited to, the following:
  1. National Fire Protection Association (NFPA) 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.
  2. NFPA 701 - Standard Methods for Fire Tests for Flame Resistant Textiles and Film.
  3. NFPA 101 - Life Safety Code

#### **1.5.7 EPA GUIDANCE DOCUMENTS**

- A. EPA guidance documents which discuss asbestos abatement work activities are listed below. These documents are made part of this section by reference. EPA publications can be ordered from (800) 424-9065.
- B. Guidance for Controlling ACM in Buildings (Purple Book) EPA 560/5-85-024
- C. Asbestos Waste Management Guidance EPA 530-SW-85-007
- D. A Guide to Respiratory Protection for the Asbestos Abatement Industry EPA-560-OPTS-86-001
- E. Guide to Managing Asbestos in Place (Green Book) TS 799 20T July 1990

#### **1.5.8 NOTICES**

- A. State and Local agencies: Send written notification as required by state and local regulations including the local fire department prior to beginning any work on ACM as follows:
- B. Copies of notifications shall be submitted to the VA for the facility's records, in the same time frame as notification is given to EPA, State, and Local authorities.

#### **1.5.9 PERMITS/LICENSES**

- A. The contractor shall apply for and have all required permits and licenses to perform asbestos abatement work as required by Federal, State, and Local regulations.

#### **1.5.10 POSTING AND FILING OF REGULATIONS**

- A. Maintain two (2) copies of applicable federal, state, and local regulations. Post one copy of each at the regulated area where workers will have daily access to the regulations and keep another copy in the Contractor's office.

#### 1.5.11 VA RESPONSIBILITIES

Prior to commencement of work:

- A. Notify occupants adjacent to regulated areas of project dates and requirements for relocation, if needed. Arrangements must be made prior to starting work for relocation of desks, files, equipment, and personal possessions to avoid unauthorized access into the regulated area. **Note: Notification of adjacent personnel is required by OSHA in 29 CFR 1926.1101 (k) to prevent unnecessary or unauthorized access to the regulated area.**
- B. Submit to the Contractor results of background air sampling; including location of samples, person who collected the samples, equipment utilized, calibration data and method of analysis. During abatement, submit to the Contractor, results of bulk material analysis and air sampling data collected during the course of the abatement. This information shall not release the Contractor from any responsibility for OSHA compliance.

#### 1.5.12 EMERGENCY ACTION PLAN AND ARRANGEMENTS

- A. An Emergency Action Plan shall be developed by prior to commencing abatement activities and shall be agreed to by the Contractor and the VA. The Plan shall meet the requirements of 29 CFR 1910.38 (a);(b).
- B. Emergency procedures shall be in written form and prominently posted in the clean room and equipment room of the decontamination unit. Everyone, prior to entering the regulated area, must read and sign these procedures to acknowledge understanding of the regulated area layout, location of emergency exits and emergency procedures.
- C. Emergency planning shall include written notification of police, fire, and emergency medical personnel of planned abatement activities; work schedule. D. Emergency planning shall include consideration of fire, explosion, hazardous atmospheres, electrical hazards, slips/trips and falls, confined spaces, and heat stress illness. Written procedures for response to emergency situations shall be developed and employee training in procedures shall be provided.
- E. Employees shall be trained in regulated area/site evacuation procedures in the event of workplace emergencies.
  1. For non-life-threatening situations: employees injured or otherwise incapacitated shall decontaminate following normal procedures with assistance from fellow workers, if necessary, before exiting the regulated area to obtain proper medical treatment.
  2. For life-threatening injury or illness, worker decontamination shall take least priority after measures to stabilize the injured worker, remove them from the regulated area, and secure proper medical treatment.
- F. Telephone numbers of any/all emergency response personnel shall be prominently posted in the clean room, along with the location of the nearest telephone.
- G. The Contractor shall provide verification of first aid/CPR training for personnel responsible for providing first aid/CPR. OSHA requires medical assistance within 3-4 minutes of a life-threatening injury/illness. Bloodborne Pathogen training shall also be verified for those personnel required to provide first aid/CPR.
- H. The Emergency Action Plan shall provide for a Contingency Plan in the event that an incident occurs that may require the modification of the standard operating procedures during abatement. Such incidents include, but are not limited to, fire; accident; power failure; negative

pressure failure; and supplied air system failure. The Contractor shall detail procedures to be followed in the event of an incident assuring that asbestos abatement work is stopped and wetting is continued until correction of the problem.

#### **1.5.13 PRE-CONSTRUCTION MEETING**

Prior to commencing the work, the Contractor shall meet with the VA Certified Industrial Hygienist (VPCIH) to present and review, as appropriate, the items following this paragraph. The Contractor's Competent Person(s) who will be on-site shall participate in the pre-start meeting. The pre-start meeting is to discuss and determine procedures to be used during the project. At this meeting, the Contractor shall provide:

- A. Proof of Contractor licensing.
- B. Proof the Competent Person(s) is trained and accredited and approved for working in this State. Verification of the experience of the Competent Person(s) shall also be presented.
- C. A list of all workers who will participate in the project, including experience and verification of training and accreditation.
- D. A list of and verification of training for all personnel who have current first-aid/CPR training. A minimum of one person per shift must have adequate training.
- E. Current medical written opinions for all personnel working on-site meeting the requirements of 29 CFR 1926.1101 (m).
- F. Current fit-tests for all personnel wearing respirators on-site meeting the requirements of 29 CFR 1926.1101 (h) and Appendix C.
- H. At this meeting the Contractor shall provide all submittals as required.
- I. Procedures for handling, packaging and disposal of asbestos waste.
- J. Emergency Action Plan and Contingency Plan Procedures.

#### **1.6 PROJECT COORDINATION**

The following are the minimum administrative and supervisory personnel necessary for coordination of the work.

##### **1.6.1 PERSONNEL**

- A. Administrative and supervisory personnel shall consist of a qualified Competent Person(s) as defined by OSHA in the Construction Standards and the Asbestos Construction Standard; Contractor Professional Industrial Hygienist and Industrial Hygiene Technicians. These employees are the Contractor's representatives responsible for compliance with these specifications and all other applicable requirements.
- B. Non-supervisory personnel shall consist of an adequate number of qualified personnel to meet the schedule requirements of the project. Personnel shall meet required qualifications. Personnel utilized on-site shall be pre-approved by the VA representative. A request for approval shall be submitted for any person to be employed during the project giving the person's name; social security number; qualifications; accreditation card with color picture; Certificate of Worker's Acknowledgment; and Affidavit of Medical Surveillance and Respiratory Protection and current Respirator Fit Test.

C. Minimum qualifications for Contractor and assigned personnel are:

1. The Contractor has conducted within the last three (3) years, three (3) projects of similar complexity and dollar value as this project; has not been cited and penalized for serious violations of federal (and state as applicable) EPA and OSHA asbestos regulations in the past three (3) years; has adequate liability/occurrence insurance for asbestos work as required by the state; is licensed in applicable states; has adequate and qualified personnel available to complete the work; has comprehensive standard operating procedures for asbestos work; has adequate materials, equipment and supplies to perform the work.
2. The Competent Person has four (4) years of abatement experience of which two (2) years were as the Competent Person on the project; meets the OSHA definition of a Competent Person; has been the Competent Person on two (2) projects of similar size and complexity as this project within the past three (3) years; has completed EPA AHERA/OSHA/State/Local training requirements/accreditation(s) and refreshers; and has all required OSHA documentation related to medical and respiratory protection.
3. The Abatement Personnel shall have completed the EPA AHERA/OSHA abatement worker course; have training on the standard operating procedures of the Contractor; has one year of asbestos abatement experience within the past three (3) years of similar size and complexity; has applicable medical and respiratory protection documentation; has certificate of training/current refresher and State accreditation/license.

All personnel should be in compliance with OSHA construction safety training as applicable and submit certification.

## **1.7 RESPIRATORY PROTECTION**

### **1.7.1 GENERAL - RESPIRATORY PROTECTION PROGRAM**

The Contractor shall develop and implement a written Respiratory Protection Program (RPP) which is in compliance with the January 8, 1998 OSHA requirements found at 29 CFR 1926.1101 and 29 CFR 1910.Subpart I;134. ANSI Standard Z88.2-1992 provides excellent guidance for developing a respiratory protection program. All respirators used must be NIOSH approved for asbestos abatement activities. The written RPP shall, at a minimum, contain the basic requirements found at 29 CFR 1910.134 (c)(1)(i - ix) - Respiratory Protection Program..

### **1.7.2 RESPIRATORY PROTECTION PROGRAM COORDINATOR**

The Respiratory Protection Program Coordinator (RPPC) must be identified and shall have two (2) year's experience coordinating RPP of similar size and complexity. The RPPC must submit a signed statement attesting to the fact that the program meets the above requirements.

### **1.7.3 SELECTION AND USE OF RESPIRATORS**

The procedure for the selection and use of respirators must be submitted to the VA as part of the Contractor's qualifications. The procedure must be written clearly enough for workers to understand. A copy of the Respiratory Protection Program must be available in the clean room

of the decontamination unit for reference by employees or authorized visitors.

#### **1.7.4 MINIMUM RESPIRATORY PROTECTION**

Minimum respiratory protection shall be a half face, HEPA filtered, air purifying respirator when fiber levels are maintained consistently at or below 0.1 f/cc. A higher level of respiratory protection may be provided or required, depending on fiber levels. Respirator selection shall meet the requirements of 29 CFR 1926.1101 (h); Table 1, except as indicated in this paragraph. Abatement personnel must have a respirator for their exclusive use.

#### **1.7.5 MEDICAL WRITTEN OPINION**

No employee shall be allowed to wear a respirator unless a physician or other licensed health care professional has provided a written determination they are medically qualified to wear the class of respirator to be used on the project while wearing whole body impermeable garments and subjected to heat or cold stress.

#### **1.7.6 RESPIRATOR FIT TEST**

All personnel wearing respirators shall have a current qualitative/quantitative fit test which was conducted in accordance with 29 CFR 1910.134 (f) and Appendix A. Quantitative fit tests shall be done for PAPRs which have been put into a motor/blower failure mode.

#### **1.7.7 RESPIRATOR FIT CHECK**

The Competent Person shall assure that the positive/negative pressure user seal check is done each time the respirator is donned by an employee. Head coverings must cover respirator head straps. Any situation that prevents an effective facepiece to face seal as evidenced by failure of a user seal check shall preclude that person from wearing a respirator inside the regulated area until resolution of the problem.

#### **1.7.8 MAINTENANCE AND CARE OF RESPIRATORS**

The Respiratory Protection Program Coordinator shall submit evidence and documentation showing compliance with 29 CFR 1910.134 (h) Maintenance and care of respirators.

### **1.8 WORKER PROTECTION**

#### **1.8.1 TRAINING OF ABATEMENT PERSONNEL**

Prior to beginning any abatement activity, all personnel shall be trained in accordance with OSHA 29 CFR 1926.1101 (k)(9) and any additional State/Local requirements. Training must include, at a minimum, the elements listed at 29 CFR 1926.1101 (k)(9)(viii). Training shall have been conducted by a third party, EPA/State approved trainer meeting the requirements of EPA 40 CFR 763 Appendix C (AHERA MAP). Initial training certificates and current refresher and accreditation proof must be submitted for each person working at the site.

### **1.8.2 MEDICAL EXAMINATIONS**

Medical examinations meeting the requirements of 29 CFR 1926.1101 (m) shall be provided for all personnel working in the regulated area, regardless of exposure levels. A current physician's written opinion as required by 29 CFR 1926.1101 (m)(4) shall be provided for each person and shall include in the medical opinion the person has been evaluated for working in a heat and cold stress environment while wearing personal protective equipment (PPE) and is able to perform the work without risk of material health impairment.

### **1.8.3 PERSONAL PROTECTIVE EQUIPMENT**

Provide whole body clothing, head coverings, foot coverings and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle. Worker protection shall meet the most stringent requirements.

## **PART 2 - PRODUCTS, MATERIALS AND EQUIPMENT**

### **2.1 MATERIALS AND EQUIPMENT**

#### **2.1.1 GENERAL REQUIREMENTS (ALL ABATEMENT PROJECTS)**

Prior to the start of work, the contractor shall provide and maintain a sufficient quantity of materials and equipment to assure continuous and efficient work throughout the duration of the project. Work shall not start unless the following items have been delivered to the site and the CPIH/CIH has submitted verification to the VA's representative.

- A. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).
- B. Store all materials subject to damage off the ground, away from wet or damp surfaces and under cover sufficient enough to prevent damage or contamination. Flammable and combustible materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated area until abatement is completed.
- C. The Contractor shall not block or hinder use of buildings by patients, staff, and visitors to the VA in partially occupied buildings by placing materials/equipment in any unauthorized location.
- D. The Competent Person shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the worksite and disposed of properly.
- E. Fire retardant poly shall be used throughout.
- F. Elevator doors shall be wrapped in 2 layers of 6 mil poly and shall be pre-printed with labels, markings and address as required by OSHA, EPA and DOT regulations.
- G. The VA shall be provided an advance copy of the MSDS as required for all hazardous chemicals under OSHA 29 CFR 1910.1200 - Hazard Communication in the pre-project submittal. Chlorinated compounds shall not be used with any spray adhesive, mastic remover or other product. Appropriate encapsulant(s) shall be provided.
- H. OSHA DANGER demarcation signs, as many and as required by OSHA 29 CFR 1926.1101(k)(7) shall be provided and placed by the Competent Person.

All other posters and notices required by Federal and State regulations shall be posted in the Clean Room.

- I. Adequate and appropriate PPE for the project and number of personnel/shifts shall be provided. All personal protective equipment issued must be based on a written hazard assessment conducted under 29 CFR 1910.132(d).

## **2.2 MONITORING, INSPECTION AND TESTING**

### **2.2.1 GENERAL**

- A. The VA will employ an independent industrial hygienist (VPIH/CIH) consultant and/or use its own IH to perform various services on behalf of the VA. The VPIH/CIH will perform the necessary inspection, and other support services to ensure that VA patients, employees, and visitors will not be adversely affected by the abatement work, and that the abatement work proceeds in accordance with these specifications, that the elevator doors have been disposed of properly. The work of the VPIH/CIH consultant in no way relieves the Contractor from their responsibility to perform the work in accordance with contract/specification requirements. The cost of the VPIH/CIH and their services will be borne by the VA except for any repeat of final inspection and testing that may be required due to unsatisfactory initial results. Any repeated final inspections and/or testing, if required, will be paid for by the Contractor.

### **2.2.2 SCOPE OF SERVICES OF THE VPIH/CIH CONSULTANT**

- A. The purpose of the work of the VPIH/CIH is to: assure quality; adherence to the specification; resolve problems; verify elevator doors have been disposed of properly.
  1. Task 1: Perform unannounced visits to spot check overall compliance of work with contract/specifications. These visits may include inspections, and all aspects of the operation.
  2. Task 2: Provide support to the VA representative such as evaluation of submittals from the Contractor, resolution of conflicts, interpret data, etc.
- B. All documentation, inspection results and testing results generated by the VPIH/CIH will be available to the Contractor for information and consideration. The Contractor shall cooperate with and support the VPIH/CIH for efficient and smooth performance of their work.
- C. The inspection results of the VPIH/CIH will be used by the VA to issue any Stop Removal orders to the Contractor during abatement work and to accept or reject a regulated area or building as decontaminated.

## **2.3 ASBESTOS HAZARD ABATEMENT PLAN**

The Contractor shall have established Asbestos Hazard Abatement Plan (AHAP) in printed form and loose leaf folder consisting of simplified text, diagrams, sketches, and pictures that establish and explain clearly the ways and procedures to be followed during all phases of the work by the contractor's personnel. The AHAP(s) must be modified as needed to address specific requirements of the project. The AHAP shall be submitted for review and approval prior to the start of any

abatement work. The minimum topics and areas to be covered by the AHAP(s) are:

- A. Minimum Personnel Qualifications
- B. Contingency Plans and Arrangements
- C. Security and Safety Procedures
- D. Respiratory Protection/Personal Protective Equipment Program and Training
- E. Medical Surveillance Program and Recordkeeping
  
- F. Removal Procedures for Class II Materials
- G. Disposal of ACM Waste
- H. Project Completion/Closeout

## **2.4 SUBMITTALS**

### **2.4.1 PRE-START MEETING SUBMITTALS**

Submit to the VA a minimum of 14 days prior to the pre-start meeting the following for review and approval. Meeting this requirement is a prerequisite for the pre-start meeting for this project:

- A. Submit a detailed work schedule for the entire project reflecting contract documents and the phasing/schedule requirements from the CPM chart.
- B. Submit a staff organization chart showing all personnel who will be working on the project and their capacity/function. Provide their qualifications, training, accreditations, and licenses, as appropriate. Provide a copy of the "Certificate of Worker's Acknowledgment" and the "Affidavit of Medical Surveillance and Respiratory Protection" for each person.
- C. Submit Asbestos Hazard Abatement Plan developed specifically for this project, incorporating the requirements of the specifications.
- D. Submit the name, location, and phone number of the approved landfill; proof/verification the landfill is approved for ACM disposal; the landfill's requirements for ACM waste; the type of vehicle to be used for transportation; and name, address, and phone number of subcontractor, if used. Proof of asbestos training for transportation personnel shall be provided.
- E. Submit required notifications if warranted and arrangements made with regulatory agencies having regulatory jurisdiction and the specific contingency/emergency arrangements made with local health, fire, ambulance, hospital authorities and any other notifications/arrangements.
- F. Submit qualifications verification: Submit the following evidence of qualifications. Make sure that all references are current and verifiable by providing current phone numbers and documentation.
  - 1. Asbestos Abatement Company: Project experience within the past 3 years; listing projects first most similar to this project: Project Name; Type of Abatement; Duration; Cost; Reference Name/Phone Number; Final Clearance; and Completion Date
  - 2. List of project(s) halted by owner, A/E, IH, regulatory agency in the last 3 years: Project Name; Reason; Date; Reference Name/Number; Resolution
  - 3. List asbestos regulatory citations (e.g., OSHA), notices of violations (e.g., Federal and state EPA), penalties, and legal actions taken against the company including and of the company's officers (including damages paid) in the last 3 years. Provide copies and all information needed for verification.



- G. Submit information on personnel: Provide a resume; address each item completely; copies of certificates, accreditations, and licenses. Submit an affidavit stating that all personnel submitted below have medical records in accordance with OSHA 29 CFR 1926.1101(m) and 29 CFR 1910.20 and that the company has implemented a medical surveillance program and written respiratory protection program, and maintains recordkeeping in accordance with the above regulations. Submit the phone number and doctor/clinic/hospital used for medical evaluations.
2. Competent Person(s)/Supervisor(s): Number; names; social security numbers; years of abatement experience as Competent Person/Supervisor; list of similar projects in size/complexity as Competent Person/Supervisor; as a worker; certificates, licenses, accreditations; proof of AHERA/OSHA specialized asbestos training; maximum number of personnel supervised on a project; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.
  3. Workers: Numbers; names; social security numbers; years of abatement experience; certificates, licenses, accreditations; training courses in asbestos abatement and respiratory protection; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.
- H. Submit copies of State license for asbestos abatement; copy of insurance policy, including exclusions with a letter from agent stating in plain language the coverage provided and the fact that asbestos abatement activities are covered by the policy; copy of SOP's incorporating the requirements of this specification; information on who provides your training, how often; who provides medical surveillance, how often; who performs and how is personal air monitoring of abatement workers conducted.

#### **2.4.4.2 SUBMITTALS DURING ABATEMENT**

- A. The Competent Person shall maintain and submit a daily log at the regulated area documenting the dates and times of the following: purpose, attendees and summary of meetings; document and discuss the resolution of unusual events, emergencies, and any cause for stopping work. Submit this information daily to the VPIH/CIH.
- B. The VPIH shall document and maintain the inspection and approval of the elevator door removal.
  1. Packaging and removal of ACM waste from regulated area.
  2. Disposal of ACM waste materials; copies of Waste Shipment Records/landfill receipts to the VA's representative.

### **PART 3 - EXECUTION**

#### **3.1 REGULATED AREA PREPARATIONS**

##### **3.1.1 SITE SECURITY**

- A. The Contractor's Competent Person shall control site security during abatement operations in order to isolate work in progress and protect adjacent personnel.

### **3.1.2 PERSONAL PROTECTIVE EQUIPMENT**

Refer to Sections 1,7 and 1.8.3 of this document.

### **3.1.3 PRE-CLEANING**

### **3.1.4 PRE-ABATEMENT ACTIVITIES**

#### **3.1.5.1 PRE-ABATEMENT MEETING**

The VA representative, upon receipt, review, and substantial approval of all pre-abatement submittals will arrange for a pre-abatement meeting between the Contractor, Competent Person(s), the VA representative(s), and the VPIH/CIH. The purpose of the meeting is to discuss any aspect of the submittals needing clarification or amplification and to discuss any aspect of the project execution and the sequence of the operation. The Contractor shall be prepared to provide any supplemental information/documentation to the VA's representative regarding any submittals, documentation, materials or equipment. Upon satisfactory resolution of any outstanding issues, the VA's representative will issue a written order to proceed to the Contractor. No abatement work of any kind described in the following provisions shall be initiated prior to the VA written order to proceed.

### **3.2 REMOVAL OF ELEVATOR DOORS**

#### **3.2.1 GENERAL**

All applicable requirements of OSHA, EPA, and DOT shall be followed during the elevator door removal. Keep materials intact; wrap as soon as possible with 2 layers of 6 mil plastic for disposal, and maintain good housekeeping in work areas during abatement.

### **3.3 DISPOSAL OF ELEVATOR DOORS**

#### **3.3.1 GENERAL**

Dispose of elevator doors in accordance with these specifications, OSHA, EPA and DOT. The landfill requirements for packaging must also be met. Transport will be in compliance with 49 CFR 100-185 regulations. Disposal shall be done at an approved landfill. Disposal of non-friable ACM shall be done in accordance with applicable regulations.

### **3.4 VISUAL INSPECTION**

#### **3.4.1 GENERAL**

Notify the VA representative 24 hours in advance for the performance of the final visual inspection.

#### **3.4.2 VISUAL INSPECTION**

Final visual inspection will include the entire area. If any debris, residue, dust or any other suspect material is detected, the area shall be cleaned up at no cost to the VA.

**3.5.1 WORK SHIFTS**

All work shall be done during administrative hours (8:00 AM to 4:30 PM) Monday - Friday excluding Federal Holidays. Any change in the work schedule must be approved in writing by the VA Representative.

**ATTACHMENT #1**

**CERTIFICATE OF COMPLETION**

DATE: \_\_\_\_\_ VA Project #: \_\_\_\_\_  
PROJECT NAME: \_\_\_\_\_ Abatement Contractor: \_\_\_\_\_  
VAMC/ADDRESS: \_\_\_\_\_

1. I certify that I have personally inspected, monitored and supervised the abatement work of (specify regulated area or Building):  
which took place from        /        /        to        /        /
2. That throughout the work all applicable requirements/regulations and the VA's specifications were met.
3. That any person who entered the regulated area was protected with the appropriate personal protective equipment and respirator and that they followed the proper entry and exit procedures and the proper operating procedures for the duration of the work.
4. That all employees of the Abatement Contractor engaged in this work were trained in respiratory protection, were experienced with abatement work, had proper medical surveillance documentation, were fit-tested for their respirator, and were not exposed at any time during the work to asbestos without the benefit of appropriate respiratory protection.
5. That I performed and supervised all inspection and testing specified and required by applicable regulations and VA specifications.
6. That the conditions inside the regulated area were always maintained in a safe and healthy condition and the maximum fiber count never exceeded 0.5 f/cc, except as described below.
7. That all abatement work was done in accordance with OSHA requirements and the manufacturer's recommendations.

CPIH/CIH Signature/Date: \_\_\_\_\_

CPIH/CIH Print Name: \_\_\_\_\_

Abatement Contractor Signature/Date: \_\_\_\_\_

Abatement Contractor Print Name: \_\_\_\_\_

**ATTACHMENT #2**

**CERTIFICATE OF WORKER'S ACKNOWLEDGMENT**

PROJECT NAME: \_\_\_\_\_ DATE: \_\_\_\_\_

PROJECT ADDRESS: \_\_\_\_\_

ABATEMENT CONTRACTOR'S NAME: \_\_\_\_\_

**WORKING WITH ASBESTOS CAN BE HAZARDOUS TO YOUR HEALTH. INHALING ASBESTOS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCERS. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, YOUR CHANCES OF DEVELOPING LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.**

Your employer's contract with the owner for the above project requires that: You must be supplied with the proper personal protective equipment including an adequate respirator and be trained in its use. You must be trained in safe and healthy work practices and in the use of the equipment found at an asbestos abatement project. You must receive/have a current medical examination for working with asbestos. These things shall be provided at no cost to you. By signing this certificate you are indicating to the owner that your employer has met these obligations.

**RESPIRATORY PROTECTION:** I have been trained in the proper use of respirators and have been informed of the type of respirator to be used on the above indicated project. I have a copy of the written Respiratory Protection Program issued by my employer. I have been provided for my exclusive use, at no cost, with a respirator to be used on the above indicated project.

**TRAINING COURSE:** I have been trained by a third party, State/EPA accredited trainer in the requirements for an AHERA/OSHA Asbestos Abatement Worker training course, 32-hours minimum duration. I currently have a valid State accreditation certificate. The topics covered in the course include, as a minimum, the following:

- Physical Characteristics and Background Information on Asbestos
- Potential Health Effects Related to Exposure to Asbestos
- Employee Personal Protective Equipment
- Establishment of a Respiratory Protection Program
- State of the Art Work Practices
- Personal Hygiene
- Additional Safety Hazards
- Medical Monitoring
- Air Monitoring
- Relevant Federal, State and Local Regulatory Requirements, Procedures, and Standards
- Asbestos Waste Disposal

**MEDICAL EXAMINATION:** I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, occupational history, pulmonary function test, and may have included a chest x-ray evaluation. The physician issued a positive written opinion after the examination.

Signature: \_\_\_\_\_ Printed Name: \_\_\_\_\_

Social Security Number: \_\_\_\_\_

Witness: \_\_\_\_\_

**ATTACHMENT #3**

**AFFIDAVIT OF MEDICAL SURVEILLANCE, RESPIRATORY PROTECTION AND TRAINING/ACCREDITATION**

VA PROJECT NAME AND NUMBER: \_\_\_\_\_

VA MEDICAL FACILITY: \_\_\_\_\_

ABATEMENT CONTRACTOR'S NAME AND ADDRESS: \_\_\_\_\_

1. I verify that the following individual

Name: \_\_\_\_\_ Social Security Number: \_\_\_\_\_

who is proposed to be employed in asbestos abatement work associated with the above project by the named Abatement Contractor, is included in a medical surveillance program in accordance with 29 CFR 1926.1101(m), and that complete records of the medical surveillance program as required by 29 CFR 1926.1101(m)(n) and 29 CFR 1910.20 are kept at the offices of the Abatement Contractor at the following address.

Address: \_\_\_\_\_

2. I verify that this individual has been trained, fit-tested and instructed in the use of all appropriate respiratory protection systems and that the person is capable of working in safe and healthy manner as expected and required in the expected work environment of this project.

3. I verify that this individual has been trained as required by 29 CFR 1926.1101(k). This individual has also obtained a valid State accreditation certificate. Documentation will be kept on-site.

4. I verify that I meet the minimum qualifications criteria of the VA specifications for a CPIH.

Signature of CPIH/CIH: \_\_\_\_\_ Date: \_\_\_\_\_

Printed Name of CPIH/CIH: \_\_\_\_\_

Signature of Contractor: \_\_\_\_\_ Date: \_\_\_\_\_

Printed Name of Contractor: \_\_\_\_\_

**ATTACHMENT #4**

**ABATEMENT CONTRACTOR/COMPETENT PERSON(S) REVIEW AND ACCEPTANCE OF THE VA'S ASBESTOS SPECIFICATIONS**

VA Project Location: \_\_\_\_\_

VA Project #: \_\_\_\_\_

VA Project Description: \_\_\_\_\_

This form shall be signed by the Asbestos Abatement Contractor Owner and the Asbestos Abatement Contractor's Competent Person(s) prior to any start of work at the VA related to this Specification. If the Asbestos Abatement Contractor's/Competent Person(s) has not signed this form, they shall not be allowed to work on-site.

I, the undersigned, have read VA's Asbestos Specification regarding the asbestos abatement requirements. I understand the requirements of the VA's Asbestos Specification and agree to follow these requirements as well as all required rules and regulations of OSHA/EPA/DOT and State/Local requirements. I have been given ample opportunity to read the VA's Asbestos Specification and have been given an opportunity to ask any questions regarding the content and have received a response related to those questions. I do not have any further questions regarding the content, intent and requirements of the VA's Asbestos Specification.

At the conclusion of the asbestos abatement, I will certify that all asbestos abatement work was done in accordance with the VA's Asbestos Specification and all ACM was removed properly and no fibrous residue remains on any abated surfaces.

Abatement Contractor Owner's Signature \_\_\_\_\_ Date \_\_\_\_\_

Abatement Contractor Competent Person(s) \_\_\_\_\_ Date \_\_\_\_\_

- - END- - - -

**SECTION 05 50 00**  
**METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.
- B. Items specified.
  - 1. Frames:
  - 2. Guards
  - 3. Gratings
  - 4. Railings:

**1.2 RELATED WORK**

- A. NOT USED
- B. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES.
- C. Prime and finish painting: Section 09 91 00, PAINTING.
- D. NOT USED

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
- C. Shop Drawings:
  - 1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
  - 2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
  - 3. Provide templates and rough-in measurements as required.
- D. Manufacturer's Certificates:
  - 1. Anodized finish as specified.
  - 2. Live load designs as specified.
- E. Design Calculations for specified live loads including dead loads.
- F. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.



**1.4 QUALITY ASSURANCE**

- A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.
- B. Each product type shall be the same and be made by the same manufacturer.
- C. Assembled product to the greatest extent possible before delivery to the site.
- D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
  - B18.6.1-97.....Wood Screws
  - B18.2.2-87(R2005).....Square and Hex Nuts
- C. American Society for Testing and Materials (ASTM):
  - A36/A36M-12.....Structural Steel
  - A47-99(R2009).....Malleable Iron Castings
  - A48-03(R2012).....Gray Iron Castings
  - A53-12.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated  
Welded and Seamless
  - A123-12.....Zinc (Hot-Dip Galvanized) Coatings on Iron and  
Steel Products
  - A240/A240M-14.....Standard Specification for Chromium and  
Chromium-Nickel Stainless Steel Plate, Sheet  
and Strip for Pressure Vessels and for General  
Applications.
  - A269-10.....Seamless and Welded Austenitic Stainless Steel  
Tubing for General Service
  - A307-12.....Carbon Steel Bolts and Studs, 60,000 PSI  
Tensile Strength
  - A391/A391M-07(R2012)....Grade 80 Alloy Steel Chain
  - A786/A786M-09.....Rolled Steel Floor Plate

- B221-13.....Aluminum and Aluminum-Alloy Extruded Bars,  
Rods, Wire, Shapes, and Tubes
- B456-11.....Electrodeposited Coatings of Copper Plus Nickel  
Plus Chromium and Nickel Plus Chromium
- B632-08.....Aluminum-Alloy Rolled Tread Plate
- C1107-13.....Packaged Dry, Hydraulic-Cement Grout  
(Nonshrink)
- D3656-13.....Insect Screening and Louver Cloth Woven from  
Vinyl-Coated Glass Yarns
- F436-11.....Hardened Steel Washers
- F468-06(R2012).....Nonferrous Bolts, Hex Cap Screws, Socket Head  
Cap Screws and Studs for General Use
- F593-13.....Stainless Steel Bolts, Hex Cap Screws, and  
Studs
- F1667-11.....Driven Fasteners: Nails, Spikes and Staples
- D. American Welding Society (AWS):
  - D1.1-10.....Structural Welding Code Steel
  - D1.2-08.....Structural Welding Code Aluminum
  - D1.3-08.....Structural Welding Code Sheet Steel
- E. National Association of Architectural Metal Manufacturers (NAAMM)
  - AMP 521-01.....Pipe Railing Manual
  - AMP 500-06.....Metal Finishes Manual
  - MBG 531-09.....Metal Bar Grating Manual
  - MBG 532-09.....Heavy Duty Metal Bar Grating Manual
- F. Structural Steel Painting Council (SSPC)/Society of Protective  
Coatings:
  - SP 1-04.....No. 1, Solvent Cleaning
  - SP 2-04.....No. 2, Hand Tool Cleaning
  - SP 3-04.....No. 3, Power Tool Cleaning
- G. Federal Specifications (Fed. Spec):
  - RR-T-650E.....Treads, Metallic and Nonmetallic, Nonskid

**PART 2 - PRODUCTS**

**2.1 DESIGN CRITERIA**

- A. In addition to the dead loads, design fabrications to support the  
following live loads unless otherwise specified.
- B. Ladders and Rungs: 120 kg (250 pounds) at any point.

- C. Railings and Handrails: 900 N (200 pounds) in any direction at any point.
- D. Floor Plates, Gratings, Covers, Trap Doors, Catwalks, and Platforms: 500 kg/m<sup>2</sup> (100 pounds per square foot).

## 2.2 MATERIALS

- A. Structural Steel: ASTM A36.
- B. Stainless Steel: ASTM A240, Type 302 or 304.
- C. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.
- D. Floor Plate:
  - 1. Steel ASTM A786.
  - 2. Aluminum: ASTM B632.
- E. Steel Pipe: ASTM A53.
  - 1. Galvanized for exterior locations.
  - 2. Type S, Grade A unless specified otherwise.
  - 3. NPS (inside diameter) as shown.
- F. Cast-Iron: ASTM A48, Class 30, commercial pattern.
- G. Malleable Iron Castings: A47.
- H. Primer Paint: As specified in Section 09 91 00, PAINTING.
- I. Stainless Steel Tubing: ASTM A269, type 302 or 304.
- J. Modular Channel Units:
  - 1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.
  - 2. Form channel within turned pyramid shaped clamping ridges on each side.
  - 3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be given a quarter turn so as to engage the channel clamping ridges. Provide each nut with a spring designed to hold the nut in place.
  - 4. Factory finish channels and parts with oven baked primer when exposed to view. Channels fabricated of ASTM A525, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
  - 5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.

K. Grout: ASTM C1107, pourable type.

L. Insect Screening: ASTM D3656.

### **2.3 HARDWARE**

#### **A. Rough Hardware:**

1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.

#### **B. Fasteners:**

1. Bolts with Nuts:
  - a. ASME B18.2.2.
  - b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
  - c. ASTM F468 for nonferrous bolts.
  - d. ASTM F593 for stainless steel.
2. Screws: ASME B18.6.1.
3. Washers: ASTM F436, type to suit material and anchorage.
4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

### **2.4 FABRICATION GENERAL**

#### **A. Material**

1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
2. Use material free of defects which could affect the appearance or service ability of the finished product.

#### **B. Size:**

1. Size and thickness of members as shown.
2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same component on similar standard commercial items or in accordance with established shop methods.

#### **C. Connections**

1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
2. Field riveting will not be approved.

3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
7. Use stainless steel connectors for removable members machine screws or bolts.

D. Fasteners and Anchors

1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship

1. General:
  - a. Fabricate items to design shown.
  - b. Furnish members in longest lengths commercially available within the limits shown and specified.
  - c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.

- d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
  - e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
  - f. Prepare members for the installation and fitting of hardware.
  - g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
  - h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.
2. Welding:
- a. Weld in accordance with AWS.
  - b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
  - c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
  - d. Finish welded joints to match finish of adjacent surface.
3. Joining:
- a. Miter or butt members at corners.
  - b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.
4. Anchors:
- a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
  - b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.
5. Cutting and Fitting:
- a. Accurately cut, machine and fit joints, corners, copes, and miters.
  - b. Fit removable members to be easily removed.

- c. Design and construct field connections in the most practical place for appearance and ease of installation.
  - d. Fit pieces together as required.
  - e. Fabricate connections for ease of assembly and disassembly without use of special tools.
  - f. Joints firm when assembled.
  - g. Conceal joining, fitting and welding on exposed work as far as practical.
  - h. Do not show rivets and screws prominently on the exposed face.
  - i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.
- F. Finish:
- 1. Finish exposed surfaces in accordance with NAAMM AMP 500 Metal Finishes Manual.
  - 2. Aluminum: NAAMM AMP 501.
    - a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
    - b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
    - c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
    - d. Painted: AA-C22R10.
  - 3. Steel and Iron: NAAMM AMP 504.
    - a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
    - b. Surfaces exposed in the finished work:
      - 1) Finish smooth rough surfaces and remove projections.
      - 2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
    - c. Shop Prime Painting:
      - 1) Surfaces of Ferrous metal:
        - a) Items not specified to have other coatings.
        - b) Galvanized surfaces specified to have prime paint.
        - c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.

d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.

e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.

2) Non ferrous metals: Comply with MAAMM-500 series.

4. Stainless Steel: NAAMM AMP-504 Finish No. 4.

G. Protection:

1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.

2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

**2.5 SUPPORTS**

A. General:

1. Fabricate ASTM A36 structural steel shapes as shown.
2. Use clip angles or make provisions for welding hangers and braces to overhead construction.
3. Field connections may be welded or bolted.

B. For Ceiling Hung Toilet Stall:

1. Use a continuous steel channel above pilasters with hangers centered over pilasters.
2. Make provision for installation of stud bolts in lower flange of channel.
3. Provide a continuous steel angle at wall and channel braces spaced as shown.
4. Use threaded rod hangers.
5. Provide diagonal angle brace where the suspended ceiling over toilet stalls does not extend to side wall of room.

C. For Wall Mounted Items:

1. For items supported by metal stud partitions.
2. Steel strip or hat channel minimum of 1.5 mm (0.0598 inch) thick.
3. Steel strip minimum of 150 mm (6 inches) wide, length extending one stud space beyond end of item supported.



4. Steel hat channels where shown. Flange cut and flattened for anchorage to stud.
5. Structural steel tube or channel for grab bar at water closets floor to structure above with clip angles or end plates formed for anchors.
6. Use steel angles for thru wall counters. Drill angle for fasteners at ends and not over 100 mm (4 inches) on center between ends.

D. For Trapeze Bars:

1. Construct assembly above ceilings as shown and design to support not less than a 340 kg (750 pound) working load at any point.
2. Fabricate trapeze supports as shown, with all exposed members, including screws, nuts, bolts and washers, fabricated of stainless steel.
3. Fabricate concealed components of structural steel shapes unless shown otherwise.
4. Stainless steel ceiling plate drilled for eye bolt.
5. Continuously weld connections where welds shown.
6. Use modular channel where shown with manufacturers bolts and fittings.
  - a. Weld ends of steel angle braces to steel plates and secure to modular channel units as shown. Drill plates for anchor bolts.
  - b. Fabricate eye bolt, special clamp bolt, and plate closure full length of modular channel at ceiling line and secure to modular channel unit with manufacturers standard fittings.

## 2.6 FRAMES

A. Elevator Entrance Wall Opening.

1. Fabricate of channel shapes, plates, and angles as shown.
2. Weld or bolt head to jamb as shown.
3. Weld clip angles to bottom of frame and top of jamb members extended to structure above for framed construction.
  - a. Provide holes for anchors.
  - b. Weld head to jamb members.

B. Channel Door Frames:

1. Fabricate of structural steel channels of size shown.
2. Miter and weld frames at corners.
3. Where anchored to masonry or embedded in concrete, weld to back of frame at each jamb, 5 mm (3/16 inch) thick by 44 mm (1-3/4 inch)

- wide steel strap anchors with ends turned 50 mm (2 inches), and of sufficient length to extend at least 300 mm (12 inches) into wall. Space anchors 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb. Weld clip angles to bottom of jambs and provide holes for expansion bolts.
4. Where anchored to concrete or masonry in prepared openings, drill holes at jambs for anchoring with expansion bolts. Weld clip angles to bottom of frame and provide holes for expansion bolt anchors as shown. Drill holes starting 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb and at top of jamb. Provide pipe spacers at holes welded to channel.
  5. Where closure plates are shown, continuously weld them to the channel flanges.
  6. Weld continuous 19 x 19 x 3 mm (3/4 x 3/4 x 1/8 inch) thick steel angles to the interior side of each channel leg at the head and jambs to form a caulking groove.
  7. Prepare frame for installation of hardware specified in Section 08 71 00, DOOR HARDWARE.
    - a. Cut a slot in the lock jamb to receive the lock bolt.
    - b. Where shown use continuous solid steel bar stops at perimeter of frame, weld or secure with countersunk machine screws at not more than 450 mm (18 inches) on center.

## **2.7 GUARDS**

- A. Wall Corner Guards:
  1. Fabricate from steel angles and furnish with anchors as shown.
  2. Continuously weld anchor to angle.
- B. Guard Angles for Overhead Doors:
  1. Cut away top portion of outstanding leg of angle and extend remaining portion of angle up wall.
  2. Weld filler piece across head of opening to jamb angles.
  3. Make provisions for fasteners and anchorage.
- C. Channel Guard at Loading Platform:
  1. Fabricate from steel channel of size shown.
  2. Weld anchors to channels as shown.
  3. Drill channel for bumper anchor bolts.
- D. Edge Guard Angles for Openings in slabs.
  1. Fabricate from steel angles of sizes and with anchorage shown.

2. Where size of angle is not shown, provide 50 x 50 x 6 mm (2 x 2 x 1/4 inch) steel angle with 32 x 5 mm (1-1/4 x 3/16 inch) strap anchors, welded to back.
3. Miter or butt angles at corners and weld.
4. Use one anchor near end and three feet on centers between end anchors.

E. Wheel Guards:

1. Construct wheel guards of not less than 16 mm (5/8 inch) thick cast iron.
2. Provide corner type, with flanges for bolting to walls.

**2.8 NOT USED**

**2.9 NOT USED**

**2.10 LOOSE LINTELS**

- A. Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.
- B. Fabricate lintels with not less than 150 mm (6 inch) bearing at each end for nonbearing masonry walls, and 200 mm (8 inch) bearing at each end for bearing walls.
- C. Provide one angle lintel for each 100 mm (4 inches) of masonry thickness as follows except as otherwise specified or shown.
  1. Openings 750 mm to 1800 mm (2-1/2 feet to 6 feet) - 100 x 90 x 8 mm (4 x 3-1/2 x 5/16 inch).
  2. Openings 1800 mm to 3000 mm (6 feet to 10 feet) - 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).
- D. For 150 mm (6 inch) thick masonry openings 750 mm to 3000 mm (2-1/2 feet to 10 feet) use one angle 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).
- E. Provide bearing plates for lintels where shown.
- F. Weld or bolt upstanding legs of double angle lintels together with 19 mm (3/4 inch bolts) spaced at 300 mm (12 inches) on centers.
- G. Insert spreaders at bolt points to separate the angles for insertion of metal windows, louver, and other anchorage.
- H. Where shown or specified, punch upstanding legs of single lintels to suit size and spacing of anchor bolts.
- I. Elevator Entrance:
  1. Fabricate lintel from plate bent to channel shape, and provide a minimum of 100 mm (4 inch) bearing each end.

2. Cut away the front leg of the channel at each end to allow for concealment behind elevator hoistway entrance frame.

#### **2.11 SHELF ANGLES**

- A. Fabricate from steel angles of size shown.
- B. Fabricate angles with horizontal slotted holes for 19 mm (3/4 inch) bolts spaced at not over 900 mm (3 feet) on centers and within 300 mm (12 inches) of ends.
- C. Provide adjustable malleable iron inserts for embedded in concrete framing.

#### **2.12 NOT USED**

#### **2.13 NOT USED**

#### **2.14 NOT USED**

#### **2.15 RAILINGS**

- A. In addition to the dead load design railing assembly to support live load specified.
- B. Fabrication General:
  1. Provide continuous welded joints, dressed smooth and flush.
  2. Standard flush fittings, designed to be welded, may be used.
  3. Exposed threads will not be approved.
  4. Form handrail brackets to size and design shown.
  5. Exterior Post Anchors.
    - a. Fabricate tube or pipe sleeves with closed ends or plates as shown.
    - b. Where inserts interfere with reinforcing bars, provide flanged fittings welded or threaded to posts for securing to concrete with expansion bolts.
    - c. Provide heavy pattern sliding flange base plate with set screws at base of pipe or tube posts.
  6. Interior Post Anchors:
    - a. Provide flanged fittings for securing fixed posts to floor with expansion bolts, unless shown otherwise.
    - b. Weld or thread flanged fitting to posts at base.
    - c. For securing removable posts to floor, provide close fitting sleeve insert or inverted flange base plate with stud bolts or rivets concrete anchor welded to the base plate.
    - d. Provide sliding flange base plate on posts secured with set screws.

e. Weld flange base plate to removable posts set in sleeves.

C. Handrails:

1. Close free ends of rail with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.
2. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.

D. Steel Pipe Railings:

1. Fabricate of steel pipe with welded joints.
2. Number and space of rails as shown.
3. Space posts for railings not over 1800 mm (6 feet) on centers between end posts.
4. Form handrail brackets from malleable iron.
5. Fabricate removable sections with posts at end of section.

6. Removable Rails:

- a. Provide "U" shape brackets at each end to hold removable rail as shown. Use for top and bottom horizontal rail when rails are joined together with vertical members.
- b. Secure rail to brackets with 9 mm (3/8 inch) stainless steel through bolts and nuts at top rail only when rails joined with vertical members.
- c. Continuously weld brackets to post.
- d. Provide slotted bolt holes in rail bracket.
- e. Weld bolt heads flush with top of rail.
- f. Weld flanged fitting to post where posts are installed in sleeves.

7. Opening Guard Rails:

- a. Fabricate rails with flanged fitting at each end to fit between wall opening jambs.
- b. Design flange fittings for fastening with machine screws to steel plate anchored to jambs.
- c. Fabricate rails for floor openings for anchorage in sleeves.

8. Gates:

- a. Fabricate from steel pipe as specified for railings.
- b. Fabricate gate fittings from either malleable iron or wrought steel.
- c. Hang each gate on suitable spring hinges of clamp on or through bolted type. Use bronze hinges for exterior gates.

- d. Provide suitable stops, so that gate will swing as shown.
9. Chains:
- a. Chains: ASTM A391, Grade 63, straight link style, normal size chain bar 8 mm (5/16 inch) diameter, eight links per 25 mm (foot) and with boat type snap hook on one end, and through type eye bolt on other end.
  - b. Fabricate eye bolt for attaching chain to pipe posts, size not less than 9 mm (3/8 inch) diameter.
  - c. Fabricate anchor at walls, for engagement of snap hook of either a 9 mm (3/8 inch) diameter eye bolt or punched angle.
  - d. Galvanize chain and bolts after fabrication.
- E. Aluminum Railings:
- 1. Fabricate from extruded aluminum.
  - 2. Use tubular posts not less than 3 mm (0.125 inch) wall thickness for exterior railings.
  - 3. Punch intermediate rails and bottom of top rails for passage of posts and machine to a close fit.
  - 4. Where shown use extruded channel sections for top rail with 13 mm (1/2 inch) thick top cover plates and closed ends.
  - 5. Fabricate brackets of extruded or wrought aluminum as shown.
  - 6. Fabricate stainless pipe sleeves with closed bottom at least six inches deep having internal dimensions at least 13 mm (1/2 inch) greater than external dimensions of posts where set in concrete.

**2.16 NOT USED**

**2.17 NOT USED**

**2.18 NOT USED**

**2.19 NOT USED**

**2.20 NOT USED**

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION, GENERAL**

- A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
- B. Items set into concrete or masonry.
  - 1. Provide temporary bracing for such items until concrete or masonry is set.
  - 2. Place in accordance with setting drawings and instructions.

3. Build strap anchors, into masonry as work progresses.
- C. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.
- D. Field weld in accordance with AWS.
  1. Design and finish as specified for shop welding.
  2. Use continuous weld unless specified otherwise.
- E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.
- F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.
- G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.
- H. Secure escutcheon plate with set screw.

### **3.2 INSTALLATION OF SUPPORTS**

- A. Anchorage to structure.
  1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
  2. Secure supports to concrete inserts by bolting or continuous welding as shown.
  3. Secure supports to mid height of concrete beams when inserts do not exist with expansion bolts and to slabs, with expansion bolts. unless shown otherwise.
  4. Secure steel plate or hat channels to studs as detailed.
- B. NOT USED
- C. Supports for Wall Mounted items:
  1. Locate center of support at anchorage point of supported item.
  2. Locate support at top and bottom of wall hung cabinets.
  3. Locate support at top of floor cabinets and shelving installed against walls.
  4. Locate supports where required for items shown.
- D. NOT USED
- E. NOT USED

F. NOT USED

G. NOT USED

H. NOT USED

I. NOT USED

**3.3 NOT USED**

**3.4 NOT USED**

**3.5 DOOR FRAMES**

- A. Secure clip angles at bottom of frames to concrete slab with expansion bolts as shown.
- B. Level and plumb frame; brace in position required.
- C. At masonry, set frames in walls so anchors are built-in as the work progresses unless shown otherwise.
- D. Set frames in formwork for frames cast into concrete.
- E. Where frames are set in prepared openings, bolt to wall with spacers and expansion bolts.

**3.6 OTHER FRAMES**

- A. Set frame flush with surface unless shown otherwise.
- B. Anchor frames at ends and not over 450 mm (18 inches) on centers unless shown otherwise.
- C. Set in formwork before concrete is placed.

**3.7 NOT USED**

**3.8 NOT USED**

**3.9 STEEL LINTELS**

- A. Use lintel sizes and combinations shown or specified.
- B. Install lintels with longest leg upstanding, except for openings in 150 mm (6 inch) masonry walls install lintels with longest leg horizontal.
- C. Install lintels to have not less than 150 mm (6 inch) bearing at each end for nonbearing walls, and 200 mm (8 inch) bearing at each end for bearing walls.

**3.10 NOT USED**

**3.11 NOT USED**

**3.12 NOT USED**

**3.13 NOT USED**

**3.14 RAILINGS**

- A. Steel Posts:
  - 1. Secure fixed posts to concrete with expansion bolts through flanged fittings except where sleeves are shown with pourable grout.



2. Install sleeves in concrete formwork.
3. Set post in sleeve and pour grout to surface. Apply beveled bead of urethane sealant at perimeter of post or under flange fitting as specified in Section 07 92 00, JOINT SEALANTS—on exterior posts.
4. Secure removable posts to concrete with either machine screws through flanged fittings which are secured to inverted flanges embedded in and set flush with finished floor, or set posts in close fitting pipe sleeves without grout.
5. Secure sliding flanged fittings to posts at base with set screws.
6. Secure fixed flanged fittings to concrete with expansion bolts.
7. Secure posts to steel with welds.

B. NOT USED

C. Anchor to Walls:

1. Anchor rails to concrete or solid masonry with machine screws through flanged fitting to steel plate.
  - a. Anchor steel plate to concrete or solid masonry with expansion bolts.
  - b. Anchor steel plate to hollow masonry with toggle bolts.
2. Anchor flanged fitting with toggle bolt to steel support in frame walls.

D. NOT USED

E. Gates:

1. Hang gate to swing as shown.
2. Bolt gate hinges to jamb post with clamp on or through bolts.

F. Chains:

1. Eye bolt chains to pipe posts.
2. Eye bolt anchoring at walls.
  - a. Expansion bolt to concrete or solid masonry.
  - b. Toggle bolt to hollow masonry of frame wall installed support.

G. Handrails:

1. Anchor brackets for metal handrails as detailed.
2. Install brackets within 300 mm (12 inches) of return of walls, and at evenly spaced intermediate points not exceeding 1200 mm (4 feet) on centers unless shown otherwise.
3. Expansion bolt to concrete or solid masonry.
4. Toggle bolt to installed supporting frame wall and to hollow masonry unless shown otherwise.

**3.15 NOT USED**

**3.16 NOT USED**

**3.17 ACCESS DOOR**

- A. Set frame in opening so that clearance at jambs is equal and secure with expansion bolts.
- B. Use shims at bolts to prevent deformation of frame members in prepared openings.
- C. Set frame in mortar bed and build in anchors as the masonry work progresses.
- D. Grout jambs solid with mortar.
- E. NOT USED

**3.18 NOT USED**

**3.19 CLEAN AND ADJUSTING**

- A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.
- B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

- - - E N D - - -

**SECTION 07 84 00  
FIRESTOPPING**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. Closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction.
- B. Closure of openings in walls against penetration of gases or smoke in smoke partitions.

**1.2 RELATED WORK**

- A. Sealants and application: Section 07 92 00, JOINT SEALANTS.
- B. Fire damper assemblies in ductwork: Section 23 31 00, HVAC DUCTS AND CASINGS.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.
- C. List of FM, UL, or WH classification number of systems installed.
- D. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.

**1.4 DELIVERY AND STORAGE**

- A. Deliver materials in their original unopened containers with manufacturer's name and product identification.
- B. Store in a location providing protection from damage and exposure to the elements.

**1.5 WARRANTY**

Firestopping work subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21, except extend the warranty period to five years.

**1.6 QUALITY ASSURANCE**

FM, UL, or WH or other approved laboratory tested products will be acceptable.

**1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

- B. American Society for Testing and Materials (ASTM):
  - E84-07.....Surface Burning Characteristics of Building Materials
  - E814-06.....Fire Tests of Through-Penetration Fire Stops
- C. Factory Mutual Engineering and Research Corporation (FM):
  - Annual Issue Approval Guide Building Materials
- D. Underwriters Laboratories, Inc. (UL):
  - Annual Issue Building Materials Directory
  - Annual Issue Fire Resistance Directory
  - 1479-03.....Fire Tests of Through-Penetration Firestops
- E. Warnock Hersey (WH):
  - Annual Issue Certification Listings

**PART 2 - PRODUCTS**

**2.1 FIRESTOP SYSTEMS**

- A. Use either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke.
- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 100 mm (4 in) nominal pipe or 0.01 m<sup>2</sup> (16 sq. in.) in overall cross sectional area.
- C. Products requiring heat activation to seal an opening by its intumescence shall exhibit a demonstrated ability to function as designed to maintain the fire barrier.
- D. Firestop sealants used for firestopping or smoke sealing shall have following properties:
  - 1. Contain no flammable or toxic solvents.
  - 2. Have no dangerous or flammable out gassing during the drying or curing of products.
  - 3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
  - 4. When used in exposed areas, shall be capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

- E. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials shall have following properties:
  - 1. Classified for use with the particular type of penetrating material used.
  - 2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.
  - 3. Intumescent products which would expand to seal the opening and act as fire, smoke, toxic fumes, and, water sealant.
- F. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84.
- G. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- H. Materials to be asbestos free.

## **2.2 SMOKE STOPPING IN SMOKE PARTITIONS**

- A. Use silicone sealant in smoke partitions as specified.
- B. Use mineral fiber filler and bond breaker behind sealant.
- C. Sealants shall have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with E84.
- D. When used in exposed areas capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

Submit product data and installation instructions, as required by article, submittals, after an on site examination of areas to receive firestopping.

### **3.2 PREPARATION**

- A. Remove dirt, grease, oil, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.
- B. Remove insulation on insulated pipe for a distance of 150 mm (six inches) on either side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.

**3.3 INSTALLATION**

- A. Do not begin work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.
- B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.
- C. Install smoke stopping seals in smoke partitions.

**3.4 CLEAN-UP AND ACCEPTANCE OF WORK**

- A. As work on each floor is completed, remove materials, litter, and debris.
- B. Do not move materials and equipment to the next-scheduled work area until completed work is inspected and accepted by the COR.
- C. Clean up spills of liquid type materials.

- - - E N D - - -

**SECTION 07 92 00**  
**JOINT SEALANTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

**1.2 RELATED WORK:**

- A. NOT USED
- B. Masonry control and expansion joint.
- C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

**1.3 QUALITY CONTROL:**

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
  - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
  - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
  - 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
  - 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates in accordance with sealant manufacturer's recommendations:
  - 1. Locate test joints where indicated or, if not indicated, as directed by Contracting Officer.

2. Conduct field tests for each application indicated below:
    - a. Each type of elastomeric sealant and joint substrate indicated.
    - b. Each type of non-elastomeric sealant and joint substrate indicated.
  3. Notify COR seven days in advance of dates and times when test joints will be erected.
  4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.
- E. VOC: Acrylic latex and Silicon sealants shall have less than 50g/l VOC content.

**1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's installation instructions for each product used.
- C. Cured samples of exposed sealants for each color where required to match adjacent material.
- D. Manufacturer's Literature and Data:
  1. Caulking compound
  2. Primers
  3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

**1.5 PROJECT CONDITIONS:**

- A. Environmental Limitations:
  1. Do not proceed with installation of joint sealants under following conditions:
    - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 °C (40 °F).
    - b. When joint substrates are wet.
- B. Joint-Width Conditions:
  1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions:
  1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.



**1.6 DELIVERY, HANDLING, AND STORAGE:**

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.
- B. Carefully handle and store to prevent inclusion of foreign materials.
- C. Do not subject to sustained temperatures exceeding 32° C (90° F) or less than 5° C (40° F).

**1.7 DEFINITIONS:**

- A. Definitions of terms in accordance with ASTM C717 and as specified.
- B. Back-up Rod: A type of sealant backing.
- C. Bond Breakers: A type of sealant backing.
- D. Filler: A sealant backing used behind a back-up rod.

**1.8 WARRANTY:**

- A. Warranty exterior sealing against leaks, adhesion, and cohesive failure, and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be extended to two years.
- B. General Warranty: Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

**1.9 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C509-06.....Elastomeric Cellular Preformed Gasket and Sealing Material.
  - C612-10.....Mineral Fiber Block and Board Thermal Insulation.
  - C717-10.....Standard Terminology of Building Seals and Sealants.
  - C834-10.....Latex Sealants.
  - C919-08.....Use of Sealants in Acoustical Applications.
  - C920-10.....Elastomeric Joint Sealants.
  - C1021-08.....Laboratories Engaged in Testing of Building Sealants.

- C1193-09.....Standard Guide for Use of Joint Sealants.
- C1330-02 (R2007).....Cylindrical Sealant Backing for Use with Cold  
Liquid Applied Sealants.
- D1056-07.....Specification for Flexible Cellular Materials—  
Sponge or Expanded Rubber.
- E84-09.....Surface Burning Characteristics of Building  
Materials.

C. Sealant, Waterproofing and Restoration Institute (SWRI).  
The Professionals' Guide

**PART 2 - PRODUCTS**

**2.1 SEALANTS:**

- A. S-1:
  - 1. ASTM C920, polyurethane or polysulfide.
  - 2. Type M.
  - 3. Class 25.
  - 4. Grade NS.
  - 5. Shore A hardness of 20-40
- B. S-2:
  - 1. ASTM C920, polyurethane or polysulfide.
  - 2. Type M.
  - 3. Class 25.
  - 4. Grade P.
  - 5. Shore A hardness of 25-40.
- C. S-3:
  - 1. ASTM C920, polyurethane or polysulfide.
  - 2. Type S.
  - 3. Class 25, joint movement range of plus or minus 50 percent.
  - 4. Grade NS.
  - 5. Shore A hardness of 15-25.
  - 6. Minimum elongation of 700 percent.
- D. S-4:
  - 1. ASTM C920 polyurethane or polysulfide.
  - 2. Type S.
  - 3. Class 25.
  - 4. Grade NS.
  - 5. Shore A hardness of 25-40.
- E. S-5:

1. ASTM C920, polyurethane or polysulfide.
2. Type S.
3. Class 25.
4. Grade P.
5. Shore hardness of 15-45.

F. S-6:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class: Joint movement range of plus 100 percent to minus 50 percent.
4. Grade NS.
5. Shore A hardness of 15-20.
6. Minimum elongation of 1200 percent.

G. S-7:

1. ASTM C920, silicone, neutral cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

H. S-8:

1. ASTM C920, silicone, acetoxo cure.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Structural glazing application.

I. S-9:

1. ASTM C920 silicone.
2. Type S.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 25-30.
6. Non-yellowing, mildew resistant.

J. S-10:

1. ASTM C920, coal tar extended fuel resistance polyurethane.
2. Type M/S.
3. Class 25.

4. Grade P/NS.
5. Shore A hardness of 15-20.

K. S-11:

1. ASTM C920 polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.
5. Shore A hardness of 35 to 50.

L. S-12:

1. ASTM C920, polyurethane.
2. Type M/S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade P/NS.
5. Shore A hardness of 25 to 50.

**2.2 NOT USED**

**2.3 COLOR:**

- A. Sealants used with exposed masonry shall match color of mortar joints.
- B. Sealants used with unpainted concrete shall match color of adjacent concrete.
- C. Color of sealants for other locations shall be light gray or aluminum, unless specified otherwise.
- D. Caulking shall be light gray or white, unless specified otherwise.

**2.4 JOINT SEALANT BACKING:**

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
  1. Type C: Closed-cell material with a surface skin.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32° C (minus 26° F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

**2.5 FILLER:**

- A. Mineral fiber board: ASTM C612, Class 1.
- B. Thickness same as joint width.
- C. Depth to fill void completely behind back-up rod.

**2.6 PRIMER:**

- A. As recommended by manufacturer of caulking or sealant material.
- B. Stain free type.

**2.7 CLEANERS-NON POUROUS SURFACES:**

Chemical cleaners acceptable to manufacturer of sealants and sealant backing material, free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

**PART 3 - EXECUTION**

**3.1 INSPECTION:**

- A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.
- B. Coordinate for repair and resolution of unsound substrate materials.
- C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

**3.2 PREPARATIONS:**

- A. Prepare joints in accordance with manufacturer's instructions and SWRI.
- B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
  - 1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
  - 2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:

- a. Concrete.
  - b. Masonry.
  - c. Unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
  4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Glazed surfaces of ceramic tile.
- C. Do not cut or damage joint edges.
- D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
  1. Do not leave gaps between ends of sealant backings.
  2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions.
  1. Apply primer prior to installation of back-up rod or bond breaker tape.
  2. Use brush or other approved means that will reach all parts of joints.
- F. Take all necessary steps to prevent three sided adhesion of sealants.

### **3.3 BACKING INSTALLATION:**

- A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.
- B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.
- C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.
- D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.

E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

F. Take all necessary steps to prevent three sided adhesion of sealants.

### **3.4 SEALANT DEPTHS AND GEOMETRY:**

A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.

B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

### **3.5 INSTALLATION:**

A. General:

1. Apply sealants and caulking only when ambient temperature is between 5° C and 38° C (40° and 100° F).
2. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
5. Avoid dropping or smearing compound on adjacent surfaces.
6. Fill joints solidly with compound and finish compound smooth.
7. Tool joints to concave surface unless shown or specified otherwise.
8. Finish paving or floor joints flush unless joint is otherwise detailed.
9. Apply compounds with nozzle size to fit joint width.
10. Test sealants for compatibility with each other and substrate. Use only compatible sealant.

B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.

C. Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.

1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.

2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

### **3.6 FIELD QUALITY CONTROL:**

- A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as recommended by sealant manufacturer:
  1. Extent of Testing: Test completed elastomeric sealant joints as follows:
    - a. Perform 10 tests for first 300 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
    - b. Perform one test for each 300 m (1000 feet) of joint length thereafter or one test per each floor per elevation.
- B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
- C. Inspect tested joints and report on following:
  1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
  2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
  3. Whether sealants filled joint cavities and are free from voids.
  4. Whether sealant dimensions and configurations comply with specified requirements.
- D. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.



- E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.
- F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

**3.7 CLEANING:**

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.
- B. After filling and finishing joints, remove masking tape.
- C. Leave adjacent surfaces in a clean and unstained condition.

**3.8 LOCATIONS:**

- A. Exterior Building Joints, Horizontal and Vertical:
  - 1. Metal to Metal: Type S-1, S-2
  - 2. Metal to Masonry or Stone: Type S-1
  - 3. Masonry to Masonry or Stone: Type S-1
  - 4. Stone to Stone: Type S-1
  - 5. Cast Stone to Cast Stone: Type S-1
  - 6. Threshold Setting Bed: Type S-1, S-3, S-4
  - 7. Masonry Expansion and Control Joints: Type S-6
  - 8. Wood to Masonry: Type S-1
- B. Metal Reglets and Flashings:
  - 1. Flashings to Wall: Type S-6
  - 2. Metal to Metal: Type S-6
- C. Sanitary Joints:
  - 1. Walls to Plumbing Fixtures: Type S-9
  - 2. Counter Tops to Walls: Type S-9
  - 3. Pipe Penetrations: Type S-9
- D. Horizontal Traffic Joints:
  - 1. Concrete Paving, Unit Pavers: Type S-11 or S-12
  - 2. Garage/Parking Decks: Type S-10
- E. High Temperature Joints over 204 degrees C (400 degrees F):

1. Exhaust Pipes, Flues, Breech Stacks: Type S-7 or S-8

F. Interior Caulking:

1. Typical Narrow Joint 6 mm, (1/4 inch) or less at Walls and Adjacent Components: Types C-1, C-2 and C-3.

2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Types C-1, C-2 and C-3.

3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1, C-2 and C-3.

4. Perimeter of Lead Faced Control Windows and Plaster or Gypsum Wallboard Walls: Types C-1, C-2 and C-3.

5. Exposed Isolation Joints at Top of Full Height Walls: Types C-1, C-2 and C-3.

6. Exposed Acoustical Joint at Sound Rated Partitions Type C-2.

7. Concealed Acoustic Sealant Type S-4, C-1, C-2 and C-3.

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**SECTION 08 11 13  
HOLLOW METAL DOORS AND FRAMES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies steel frames and related components.
- B. Terms relating to steel frames as defined in ANSI A123.1 and as specified.

**1.2 RELATED WORK**

- A. Door Hardware: Section 08 71 00, DOOR HARDWARE.

**1.3 TESTING**

- A. An independent testing laboratory shall perform testing.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers Literature and Data:
  - 1. Fire rated frames, showing conformance with NFPA 80 and Underwriters Laboratory, Inc., or Intertek Testing Services or Factory Mutual fire rating requirements.

**1.5 SHIPMENT**

- A. Prior to shipment label each frame to show location, size, door swing and other pertinent information.
- B. Fasten temporary steel spreaders across the bottom of each door frame.

**1.6 STORAGE AND HANDLING**

- A. Store doors and frames at the site under cover.
- B. Protect from rust and damage during storage and erection until completion.

**1.7 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. Federal Specifications (Fed. Spec.):
  - L-S-125B.....Screening, Insect, Nonmetallic
- C. Door and Hardware Institute (DHI):
  - A115 Series.....Steel Door and Frame Preparation for Hardware, Series A115.1 through A115.17 (Dates Vary)

- D. Steel Door Institute (SDI):
  - 113-01 (R2006).....Thermal Transmittance of Steel Door and Frame Assemblies
  - 128-09.....Acoustical Performance for Steel Door and Frame Assemblies
- E. American National Standard Institute:
  - A250.8-2003 (R2008).....Specifications for Standard Steel Doors and Frames
- F. American Society for Testing and Materials (ASTM):
  - A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  - A568/568-M-11.....Steel, Sheet, Carbon, and High-Strength, Low-alloy, Hot-Rolled and Cold-Rolled
  - A1008-10.....Steel, sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability
  - B209/209M-10.....Aluminum and Aluminum-Alloy Sheet and Plate
  - B221/221M-12.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes
  - D1621-10.....Compressive Properties of Rigid Cellular Plastics
  - D3656-07.....Insect Screening and Louver Cloth Woven from Vinyl Coated Glass Yarns
  - E90-09.....Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
- G. The National Association Architectural Metal Manufacturers (NAAMM):
  - Metal Finishes Manual (AMP 500-06)
- H. National Fire Protection Association (NFPA):
  - 80-13.....Fire Doors and Fire Windows
- I. Underwriters Laboratories, Inc. (UL):
  - Fire Resistance Directory
- J. Intertek Testing Services (ITS):
  - Certifications Listings...Latest Edition
- K. Factory Mutual System (FM):
  - Approval Guide

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Stainless Steel: ASTM A167, Type 302 or 304; finish, NAAMM Number 4.
- B. Sheet Steel: ASTM A1008, cold-rolled for panels (face sheets) of doors.
- C. Anchors, Fastenings and Accessories: Fastenings anchors, clips connecting members and sleeves from zinc coated steel.
- D. Prime Paint: Paint that meets or exceeds the requirements of A250.8.

### **2.2 METAL FRAMES**

- A. General:
  - 1. ANSI A250.8, 1.3 mm (0.053 inch) thick sheet steel, types and styles as shown or scheduled.
  - 2. Frames for exterior doors: Fabricate from 1.7 mm (0.067 inch) thick galvanized steel conforming to ASTM A525.
- B. Reinforcement and Covers:
  - 1. ANSI A250.8 for, minimum thickness of steel reinforcement welded to back of frames.
  - 2. Provide mortar guards securely fastened to back of hardware reinforcements.
- C. Terminated Stops: ANSI A250.8.
- D. Two piece frames:
  - 1. One piece unequal leg finished rough buck sub-frames as shown, drilled for anchor bolts.
  - 2. Unequal leg finished frames formed to fit subframes and secured to subframe legs with countersunk, flat head screws, spaced 300 mm (12 inches) on center at head and jambs on each side.
  - 3. Preassemble at factory for alignment.
- E. Frame Anchors:
  - 1. Floor anchors:
    - a. Where floor fills occur, provide extension type floor anchors to compensate for depth of fill.
    - b. At bottom of jamb use 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive two 6 mm (1/4 inch) floor bolts..
    - c. Where sill sections occur, provide continuous 1 mm (0.042 inch) thick steel rough bucks drilled for 6 mm (1/4 inch) floor bolts

and frame anchor screws. Space floor bolts at 50 mm (24 inches) on center.

2. Jamb anchors:
  - a. Locate anchors on jambs near top and bottom of each frame, and at intermediate points not over 600 mm (24 inches) apart.
  - b. Form jamb anchors of not less than 1 mm (0.042 inch) thick steel unless otherwise specified.
  - c. Anchors for stud partitions: Either weld to frame or use lock-in snap-in type. Provide tabs for securing anchor to the sides of the studs.
  - d. Anchors for frames set in prepared openings:
    - 1) Steel pipe spacers with 6 mm (1/4 inch) inside diameter welded to plate reinforcing at jamb stops or hat shaped formed strap spacers, 50 mm (2 inches) wide, welded to jamb near stop.
    - 2) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass thru frame and spacers.
    - 3) Two piece frames: Subframe or rough buck drilled for 6 mm (1/4 inch) bolts.
  - e. Anchors for observation windows and other continuous frames set in stud partitions.
    - 1) In addition to jamb anchors, weld clip anchors to sills and heads of continuous frames over 1200 mm (4 feet) long.
    - 2) Anchors spaced 600 mm (24 inches) on centers maximum.
  - f. Modify frame anchors to fit special frame and wall construction and provide special anchors where shown or required.

### **2.3 SHOP PAINTING**

ANSI A250.8.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Plumb, align and brace frames securely until permanent anchors are set.
  1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
  2. Use wood spreaders at bottom of frame if the shipping spreader is removed.
  3. Protect frame from accidental abuse.

4. Where construction will permit concealment, leave the shipping spreaders in place after installation, otherwise remove the spreaders after the frames are set and anchored.
5. Remove wood spreaders and braces only after the walls are built and jamb anchors are secured.

B. Floor Anchors:

1. Anchor the bottom of door frames to floor with two 6 mm (1/4 inch) diameter expansion bolts. Use 9 mm (3/8 inch) bolts on lead lined frames.
2. Power actuated drive pins may be used to secure frame anchors to concrete floors.

C. Jamb Anchors:

1. Secure anchors to sides of studs with two fasteners through anchor tabs. Use steel drill screws to steel studs.

**3.2 INSTALLATION OF DOORS AND APPLICATION OF HARDWARE**

- A. Install hardware as specified in Section 08 71 00, DOOR HARDWARE.

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**SECTION 08 71 00**  
**DOOR HARDWARE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Door hardware and related Items necessary for complete installation and operation of doors.

**1.2 RELATED WORK**

- A. Caulking: Section 07 92 00 JOINT SEALANTS.
- B. Painting: Section 09 91 00, PAINTING.

**1.3 GENERAL**

- A. All hardware shall comply with UFAS, (Uniform Federal Accessible Standards) unless specified otherwise.
- B. Provide rated door hardware assemblies where required by most current version of the International Building Code (IBC).
- C. Hardware for application on metal and wood doors and frames shall be made to standard templates. Furnish templates to the fabricator of these items in sufficient time so as not to delay the construction.
- D. The following items shall be of the same manufacturer, except as otherwise specified:
  - 1. Hinges for Hollow Metal Doors.
  - 2. Door Locks

**1.4 WARRANTY**

- A. Power assisted door operators shall be subject to the terms of FAR Clause 52.246-21, except that the Warranty period shall be two years in lieu of one year for all items except as noted below:
  - 1. Locks, latchsets, and panic hardware: 5 years.
  - 2. Door closers and continuous hinges: 10 years.

**1.5 MAINTENANCE MANUALS**

- A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS", furnish maintenance manuals and instructions on all door hardware. Provide installation instructions with the submittal documentation.

**1.6 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Submit 6 copies of the schedule per Section 01 33 23.



B. Hardware Schedule: Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (if fire rated and listed)	ANSI/BHMA Finish Designation

C. Samples and Manufacturers' Literature:

1. Samples: All hardware items (proposed for the project) that have not been previously approved by Builders Hardware Manufacturers Association shall be submitted for approval. Tag and mark all items with manufacturer's name, catalog number and project number.
2. Samples are not required for hardware listed in the specifications by manufacturer's catalog number, if the contractor proposes to use the manufacturer's product specified.

D. Certificate of Compliance and Test Reports: Submit certificates that hardware conforms to the requirements specified herein. Certificates shall be accompanied by copies of reports as referenced. The testing shall have been conducted either in the manufacturer's plant and certified by an independent testing laboratory or conducted in an independent laboratory, within four years of submittal of reports for approval.

**1.7 DELIVERY AND MARKING**

A. Deliver items of hardware to job site in their original containers, complete with necessary appurtenances including screws, keys, and instructions. Tag one of each different item of hardware and deliver to COR for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in COR's office until all other similar items have been installed in project, at which time the COR will deliver items on file to Contractor for installation in predetermined locations on the project.

**1.8 PREINSTALLATION MEETING**

- A. Convene a preinstallation meeting not less than 30 days before start of installation of door hardware. Require attendance of parties directly affecting work of this section, including Contractor and Installer, Project Engineer and VA Locksmith, and Hardware Manufacturer's Representative. Review the following:
  - 1. Inspection of door hardware.
  - 2. Job and surface readiness.
  - 3. Coordination with other work.
  - 4. Protection of hardware surfaces.
  - 5. Substrate surface protection.
  - 6. Installation.
  - 7. Adjusting.
  - 8. Repair.
  - 9. Field quality control.
  - 10. Cleaning.

**1.9 INSTRUCTIONS**

- A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mutes, thresholds and the like specified herein, hardware requirements for each door are indicated on drawings by symbols. Symbols for hardware sets consist of letters (e.g., "HW") followed by a number. Each number designates a set of hardware items applicable to a door type.

**1.10 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. In text, hardware items are referred to by series, types, etc., listed in such specifications and standards, except as otherwise specified.
- B. American Society for Testing and Materials (ASTM):
  - F883-04.....Padlocks
  - E2180-07.....Standard Test Method for Determining the  
Activity of Incorporated Antimicrobial Agent(s)  
In Polymeric or Hydrophobic Materials

C. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):

- A156.1-06.....Butts and Hinges
- A156.2-03.....Bored and Pre-assembled Locks and Latches
- A156.4-08.....Door Controls (Closers)
- A156.5-14.....Cylinders and Input Devices for Locks.
- A156.6-05.....Architectural Door Trim
- A156.8-05.....Door Controls-Overhead Stops and Holders
- A156.13-05.....Mortise Locks and Latches Series 1000
- A156.16-08.....Auxiliary Hardware
- A156.17-04 .....Self-Closing Hinges and Pivots
- A156.18-06.....Materials and Finishes
- A156.22-05.....Door Gasketing and Edge Seal Systems
- A156.23-04.....Electromagnetic Locks
- A156.26-06.....Continuous Hinges
- A156.28-07 .....Master Keying Systems
- A156.29-07 .....Exit Locks and Alarms
- A156.30-03 .....High Security Cylinders
- A156.31-07 .....Electric Strikes and Frame Mounted Actuators
- A156.36-10.....Auxiliary Locks
- A250.8-03.....Standard Steel Doors and Frames

D. National Fire Protection Association (NFPA):

- 80-10.....Fire Doors and Other Opening Protectives
- 101-09.....Life Safety Code

E. Underwriters Laboratories, Inc. (UL):

Building Materials Directory (2008)

**PART 2 - PRODUCTS**

**2.1 CONTINUOUS HINGES**

- A. ANSI/BHMA A156.26, Grade 1-600.
  - 1. Listed under Category N in BHMA's "Certified Product Directory."
- B. General: Minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete

- C. Continuous, Barrel-Type Hinges: Hinge with knuckles formed around a Teflon-coated 6.35mm (0.25-inch) minimum diameter pin that extends entire length of hinge.
1. Base Metal for Interior Hinges: Stainless steel.
  2. Where required to clear adjacent casing, trim, and wall conditions and allow full door swing, provide wide throw hinges of minimum width required.
  3. Provide with manufacturer's cut-outs for separate mortised power transfers and/or mortised automatic door bottoms where they occur.
  4. Where thru-wire power transfers are integral to the hinge, provide hinge with easily removable portion to allow easy access to wiring connections.
  5. Where models are specified that provide an integral wrap-around edge guard for the hinge edge of the door, provide manufacturer's adjustable threaded stud and machine screw mechanism to allow the door to be adjusted within the wrap-around edge guard.

## **2.2 DOOR CLOSING DEVICES**

- A. Closing devices shall be products of one.

## **2.3 HEAD AND FLOOR PIVOTS**

- A. Comply with ANSI A5702. Pivots for non-labeled doors shall be cast, forged or extruded brass or bronze.
- B. Where double acting pivots appear in hardware set provide surface mounted anchor housing at floor and concealed housing at head..

## **2.4 DOOR STOPS**

- A. Conform to ANSI A156.16.
- B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For concrete, masonry or quarry tile construction, use lead expansion shields for mounting door stops.
- C. Where cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers Type L02251 (rubber pads having concave face) to receive turn piece or button.
- D. Do not provide floor stops
- E. Omit stops where automatic operated doors occur.

**2.5 LOCKS AND LATCHES**

- A. Conform to ANSI A156.2. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall match duty and pin numbers of existing. Cylinders for all locksets shall be removable core type. Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. Provide temporary keying device or construction core to allow opening and closing during construction and prior to the installation of final cores.
- B. In addition to above requirements, locks and latches shall comply with following requirements:
  - 1. Mortise Lock and Latch Sets: Conform to ANSI/BHMA A156.13. Mortise locksets shall be series 1000, minimum Grade 2. All locksets and latchsets shall have lever handles fabricated from cast stainless steel. Provide sectional (lever x rose) lever design matching existing hardware. No substitute lever material shall be accepted. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box.

**2.6 ELECTRIC STRIKES**

- A. ANSI/ BHMA A156.31 Grade 1.
- B. General: Use fail-safe electric.

**2.7 KEYS**

- A. Stamp all keys with change number and key set symbol. Furnish keys in quantities as follows:

<b>Locks/Keys</b>	<b>Quantity</b>
Cylinder locks	2 keys each
Cylinder lock change key blanks	10 each different key way
Master-keyed sets	6 keys each
Grand Master sets	6 keys each
Great Grand Master set	5 keys
Control key	2 keys

## **2.8 ARMOR PLATES AND DOOR EDGING**

- A. Conform to ANSI Standard A156.6.
- B. Provide protective plates and door edging as specified below:
  - 1. Armor plates of metal, Type J100 series.
  - 2. Armor plates for doors are listed under Article "Hardware Sets".  
Armor plates shall be thickness as noted in the hardware set, height as noted on the drawings and 38 mm (1-1/2 inches) less than width of doors. Provide armor plates beveled on all 4 edges (B4E).
  - 3. Provide stainless steel edge guards where so specified at wood doors. Provide mortised type instead of surface type except where door construction and/or ratings will not allow. Provide edge guards of bevel and thickness to match wood door. Provide edge guards with factory cut-outs for door hardware that must be installed through or extend through the edge guard. Provide full-height edge guards except where door rating does not allow; in such cases, provide edge guards to height of bottom of typical lockset armor front. Forward edge guards to wood door manufacturer for factory installation on doors.

## **2.9 COMBINATION PUSH AND PULL PLATES**

- A. Conform to ANSI 156.6. Type J303, stainless steel 3 mm (1/8 inch) thick, 80 mm (3-1/3 inches) wide by 800 mm (16 inches) high), top and bottom edges shall be rounded. Secure plates to wood doors with 38 mm (1-1/2 inch) long No. 12 wood screws. Cut plates for turn pieces, and cylinders where required. Pull shall be mounted down.

## **2.10 FINISHES**

- A. Exposed surfaces of hardware shall have ANSI A156.18, finishes as specified below. Finishes on all hinges, pivots, closers, thresholds, etc., shall be as specified below under "Miscellaneous Finishes." For field painting (final coat) of ferrous hardware, see Section 09 91 00, PAINTING.
- B. 626 or 630: All surfaces, except where other finishes are specified.
- C. Miscellaneous Finishes:
  - 1. Hinges --interior doors: 652 or 630.
  - 2. Pivots: Match door trim.
  - 3. Door operators: Factory applied paint finish. Dull or Satin Aluminum color.

- 4. Cover plates for floor hinges and pivots: 630.
- 5. Other primed steel hardware: 600.
- D. Hardware Finishes for Existing Buildings: U.S. Standard finishes shall match finishes of hardware in (similar) existing spaces except where otherwise specified.
- E. Anti-microbial Coating: All hand-operated hardware (levers, pulls, push bars, push plates, paddles, and panic bars) shall be provided with an anti-microbial/anti-fungal coating that has passed ASTM E2180 tests. Coating to consist of ionic silver (Ag<sup>+</sup>). Silver ions surround bacterial cells, inhibiting growth of bacteria, mold, and mildew by blockading food and respiration supplies.

**2.11 BASE METALS**

- A. Apply specified U.S. Standard finishes on different base metals as following:

<b>Finish</b>	<b>Base Metal</b>
652	Steel
626	Brass or bronze
630	Stainless steel

**PART 3 - EXECUTION**

**3.1 HARDWARE HEIGHTS**

- A. For existing buildings locate hardware on doors at heights to match existing hardware. The Contractor shall visit the site, verify location of existing hardware and submit locations to VA COR for approval.
- B. Hardware Heights from Finished Floor:
  - 1. Locksets and latch sets centerline of strike 1024 mm (40-5/16 inches).
  - 2. Centerline of door pulls to be 1016 mm (40 inches).
  - 3. Push plates and push-pull shall be 1270 mm (50 inches) to top of plate.
  - 4. Locate other hardware at standard commercial heights. Locate push and pull plates to prevent conflict with other hardware.

**3.2 INSTALLATION**

- A. Closer and operator devices shall be equipped and mounted to provide maximum door opening permitted by building construction or equipment.
- B. Fastenings: Suitable size and type and shall harmonize with hardware as to material and finish. Provide machine screws and lead expansion

shields to secure hardware to concrete, ceramic or quarry floor tile, or solid masonry. Fiber or rawl plugs and adhesives are not permitted.

- C. After locks have been installed; show in presence of COR that keys operate their respective locks in accordance with keying requirements. (All keys, Master Key level and above shall be sent Registered Mail to the Medical Center Director along with the bitting list. Also a copy of the invoice shall be sent to the COR for his records.) Installation of locks which do not meet specified keying requirements shall be considered sufficient justification for rejection and replacement of all locks installed on project.

### **3.3 FINAL INSPECTION**

- A. Installer to provide letter to VA COR that upon completion, installer has visited the Project and has accomplished the following:
1. Re-adjust hardware.
  2. Evaluate maintenance procedures and recommend changes or additions, and instruct VA personnel.
  3. Identify items that have deteriorated or failed.
  4. Submit written report identifying problems.

### **3.4 DEMONSTRATION**

- A. Demonstrate efficacy of mechanical hardware and electrical, and electronic hardware systems, including adjustment and maintenance procedures, to satisfaction of COR and VA Locksmith.

### **3.5 HARDWARE SETS**

- A. Following sets of hardware correspond to hardware symbols shown on drawings. Only those hardware sets that are shown on drawings will be required. Disregard hardware sets listed in specifications but not shown on drawings.
- B. Hardware Consultant working on a project will be responsible for providing additional information regarding these hardware sets. The numbers shown in the following sets come from BHMA standards.

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**SECTION 09 05 16**  
**SUBSURFACE PREPARATION FOR FLOOR FINISHES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

A. This section specifies subsurface preparation requirements for areas to receive the installation of applied and resinous flooring. This section includes removal of existing floor coverings, testing concrete for moisture and pH, remedial floor coating for concrete floor slabs having unsatisfactory moisture or pH conditions, floor leveling and repair as required.

**1.2 RELATED WORK**

A. SECTION 09 65 19 RESILIENT TILE FLOORING

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and TEST DATA.
- B. Written approval confirming product compatibility with subfloor material manufacturer and the flooring manufacturer
- C. Product Data:
1. Moisture remediation system
  2. Underlayment Primer
  3. Cementitious Self-Leveling Underlayment
  4. Cementitious Trowel-Applied Underlayment (Not suitable for resinous floor finishes)
- D. Test Data:
1. Moisture test and pH results performed by a qualified independent testing agency or warranty holding manufacturer's technical representative.

**1.4 DELIVERY AND STORAGE**

- A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- B. Store material to prevent damage or contamination.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):

D638-10 (2010)	Test Method for Tensile Properties of Plastics
D4259-88 (2012)	Standard Practice for Abrading Concrete to alter the surface profile of the concrete and to remove foreign materials and weak surface laitance.
C109/C109M-12 (2012)	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens) Modified Air Cure Only
D7234-12 (2012)	Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
E96/E96M -12 (2012)	Standard Test Methods for Water Vapor Transmission of Materials
F710-11 (2011)	Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
F1869-11 (2011)	Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
F2170-11 (2011)	Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes
C348-08 (2008)	Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars
C191-13 (2013)	Standard Test Method for Time of Setting of Hydraulic Cement by Vicat Needle

**PART 2 - PRODUCTS**

**2.1 MOISTURE REMEDIATION COATING**

A. System Descriptions:

1. Moisture remediation is not anticipated. If testing indicates moisture issues, this section applies.
2. High-solids, epoxy system designed to suppress excess moisture in concrete prior to an overlayment. For use under resinous products, VCT, tile and carpet where issues caused by moisture vapor are a concern.

B. Products: Subject to compliance with applicable fire, health, environmental, and safety requirements for storage, handling, installation, and clean up.

C. System Components: Verify specific requirements as systems vary by manufacturer. Verify build up layers and installation method. Verify compatibility with substrate. Use manufacturer's standard components, compatible with each other and as follows:

- 1. Liquid applied coating:
  - a. Resin: epoxy.
  - b. Formulation Description: Multiple component high solids.
  - c. Application: Per manufacturer's written installation requirements.
  - d. Thickness: minimum 10 mils
- D. Material Vapor Permeance: Application shall achieve a permeance rating of less than 0.1 perm in accordance with ASTM E96/E96M.
- E. Maximum RH requirement: 100% testing in accordance with ASTM F2170.

Property	Test	Value
Tensile Strength	ASTM D638	4,400 psi
Volatile Organic Compound Limits (V.O.C.)	SCAMD Rule 1113	25 grams per liter
Permeance	ASTM E96	0.1 perms
Tensile Modulus	ASTM D638	1.9X10 <sup>5</sup> psi
Percent Elongation	ASTM D638	12%
Cure Rate	Per manufacture's Data	4 hours Tack free with 24hr recoat window
Bond Strength	ASTM D7234	100% bond to concrete failure

**2.2 CEMENTITIOUS SELF-LEVELING UNDERLAYMENT**

- A. System Descriptions:
  - 1. High performance self-leveling underlayment resurfacer. Single component, self-leveling, cementitious material designed for easy application as an underlayment for all types of flooring materials. It is used for substrate repair and leveling.
- B. Products: Subject to compliance with applicable fire, health, environmental, and safety requirements for storage, handling, installation, and clean up. Gypsum-based products are unacceptable.
- C. System Characteristics:
  - 1. Wearing Surface: smooth
  - 2. Thickness: Per architectural drawings, ranging from feathered edge to 1", per application. Applications greater than 1" require additional 3/8" aggregate to mix or as recommended by manufacturer.

- D. Underlayment shall be calcium aluminate cement-based, containing Portland cement. Gypsum-based products are unacceptable.
- E. Compressive Strength: Minimum 4100 psi in 28 days in accordance with ASTM C109/C109M.
- F. Flexural Strength: Minimum 1000 psi in 28 days in accordance with ASTM C348
- G. Dry Time: Underlayment shall receive the application of floor coverings in 16 hours.
- H. Primer: compatible and as recommended by manufacturer for use over intended substrate
- I. System Components: Manufacturer's standard components that are compatible with each other and as follows:
  - 1. Primer:
    - a. Resin: copolymer
    - b. Formulation Description: single component ready to use.
    - c. Application Method: Squeegee and medium nap roller.
    - d. All puddles shall be removed, and material shall be allowed to dry, 1-2 hours at 70F/2
    - e. Number of Coats: (1) one.
  - 2. Grout Resurfacing Base:
    - a. Formulation Description: Single component, cementitious self-leveling high-early and high-ultimate strength grout.
    - b. Application Method: colloidal mix pump, cam rake, spike roll.
      - 1) Thickness of Coats: Per architectural scope, 1" lifts.
      - 2) Number of Coats: More than one if needed.
    - c. Aggregates: for applications greater than 1 inch, require additional 3/8" aggregate to mix.

Property	Test	Value
Compressive Strength	ASTM C109/C109M	2,200 psi @ 24 hrs 3,000 psi @ 7 days
Initial set time Final Set time	ASTM C191	30-45 min. 1 to 1.5 hours
Bond Strength	ASTM D7234	100% bond to concrete failure

**2.3 CEMENTITIOUS TROWEL-APPLIED UNDERLAYMENT (NOT SUITABLE FOR RESINOUS FLOOR FINISHES)**

- A. Underlayment shall be calcium aluminate cement-based, containing Portland cement. Gypsum-based products are unacceptable.
- B. Compressive Strength: Minimum 4000 psi in 28 days
- C. Trowel-applied underlayment shall not contain silica quartz (sand).
- D. Dry Time: Underlayment shall receive the application of floor covering in 15-20 minutes.

**PART 3 - EXECUTION**

**3.1 ENVIRONMENTAL REQUIREMENTS**

- A. Maintain ambient temperature of work areas at not less than 16 degree C (60 degrees F), without interruption, for not less than 24 hours before testing and not less than three days after testing.
- B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation.
- C. Do not install materials when the temperatures of the substrate or materials are not within 60-85 degrees F/ 16-30 degrees C.

**3.2 SURFACE PREPARATION**

- A. Existing concrete slabs with existing floor coverings:
  - 1. Conduct visual observation of existing floor covering for adhesion, water damage, alkaline deposits, and other defects.
  - 2. Remove existing floor covering and adhesives. Comply with local, state and federal regulations and the RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to the floor covering being removed.
- B. Concrete shall meet the requirements of ASTM F710 and be sound, solid, clean, and free of all oil, grease, dirt, curing compounds, and any substance that might act as a bond-breaker before application. As required prepare slab by mechanical methods. No chemicals or solvents shall be used.
- C. General: Prepare and clean substrates according to flooring manufacturer's written instructions for substrate indicated.
- D. Prepare concrete substrates per ASTM D4259 as follows:
  - 1. Dry abrasive blasting.
  - 2. Wet abrasive blasting.
  - 3. Vacuum-assisted abrasive blasting.

4. Centrifugal-shot abrasive blasting.
5. Comply with manufacturer's written instructions.
- E. Repair damaged and deteriorated concrete according to flooring manufacturer's written recommendations.
- F. Verify that concrete substrates are dry.
- G. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of per flooring manufactures formal and project specific written recommendation.
- H. Perform in situ probe test, ASTM F2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity per flooring manufacture's formal and project specific written recommendation.
- I. Provide a written report showing test placement and results.
- J. Prepare joints in accordance with material manufacturer's instructions.
- K. Alkalinity: Measure surface pH in accordance with procedures provided in ASTM F710 or as outlined by qualified testing agency or flooring manufacturer's technical representative.
- L. Tolerances: Subsurface shall meet the flatness and levelness tolerance specified on drawings or recommended by the floor finish manufacturer. Tolerance shall also not to exceed 1/4" deviation in 10'. As required, install underlayment to achieve required tolerance.
- M. Other Subsurface: For all other subsurface conditions, such as wood or metal, contact the floor finish or underlayment manufacturer, as appropriate, for proper preparation practices.

### **3.3 MOISTURE REMEDIATION COATING:**

- A. Where results of relative humidity testing (ASTM F2170) exceed the requirements of the specified flooring manufacturer, apply remedial coating as specified to correct excessive moisture condition.
- B. Prior to remedial floor coating installation mechanically prepare the concrete surface to provide a concrete surface profile in accordance with ASTM D4259.
- C. Mix and apply moisture remediation coating in accordance with manufacturer's instructions.

**3.4 CEMENTITIOUS UNDERLAYMENT:**

- A. Install cementitious self-leveling underlayment as required to correct surface defects, floor flatness or levelness corrections to meet the tolerance requirements as or detailed on drawings, address non-moving cracks or joints, provide a smooth surface for the installation of floor covering, or meet elevation requirements detailed on drawings.
- B. Mix and apply in accordance with manufacturer's instructions.

**3.5 PROTECTION**

- A. Prior to the installation of the finish flooring, the surface of the underlayment should be protected from abuse by other trades by the use of plywood, tempered hardwood, or other suitable protection course

**3.6 FIELD QUALITY CONTROL**

- A. Where specified, field sampling of products shall be conducted by a qualified, independent testing facility.

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**SECTION 09 06 00**  
**SCHEDULE FOR FINISHES**

**PART I - GENERAL**

**1.1 DESCRIPTION**

This section contains a coordinated system in which requirements for materials specified in other sections shown are identified by abbreviated material names and finish codes in the room finish schedule or shown for other locations.

**1.2 MANUFACTURERS**

Manufacturer's trade names and numbers used herein are only to identify colors, finishes, textures and patterns. Products of other manufacturer's equivalent to colors, finishes, textures and patterns of manufacturers listed that meet requirements of technical specifications will be acceptable upon approval in writing by contracting officer for finish requirements.

**1.3 SUBMITALS**

Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES—provide quadruplicate samples for color approval of materials and finishes specified in this section.



**1.4 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.
- B. MASTER PAINTING INSTITUTE: (MPI)  
 2001.....Architectural Painting Specification Manual

**PART 2- PRODUCTS**

**2.8 DIVISION 08 - OPENINGS**

A. SECTION 05 51 00, METAL STAIRS

Component	Finish	Color
Guard Rails (Exterior)	Hot dip galvanized	---
New and Revised Guard Rails (Interior)	Paint	As directed by COR
New and Revised Handrails	Paint	As directed by COR

B. SECTION 08 11 13, HOLLOW METAL DOORS AND FRAMES

Paint both sides of door and frames same color including ferrous metal louvers, and hardware attached to door	
Component	Color of Paint Type and Gloss
Door	Dark Brown Semi-Gloss
Frame	Dark Brown Semi-Gloss

C. SECTION 09 65 13, RESILIENT BASE

Finish Code	Item	Height	Manufacturer	Mfg Name/No.
RB	Rubber Base (RB)	4"	Roppe	Color to match existing

D. SECTION 09 91 00, PAINT AND COATINGS

1. Sheen specified in Section 09 91 00. Color shall match existing rooms to be remodeled.

--- E N D---

**SECTION 09 51 00**  
**ACOUSTICAL CEILINGS**

**PART 1- GENERAL**

**1.1 DESCRIPTION**

- A. Metal ceiling suspension system for acoustical ceilings.
- B. Acoustical units.

**1.2 SUBMITTAL**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples:
  - 1. Acoustical units, each type, with label indicating conformance to specification requirements, including units specified to match existing.
  - 2. Colored markers for units providing access.
- C. Manufacturer's Literature and Data:
  - 1. Ceiling suspension system, each type, showing complete details of installation, including suspension system specified to match existing and upward access system details for concealed grid systems.
  - 2. Acoustical units, each type
- D. Manufacturer's Certificates: Acoustical units, each type, in accordance with specification requirements.

**1.4 DEFINITIONS**

- A. Standard definitions as defined in ASTM C634.
- B. Terminology as defined in ASTM E1264.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A641/A641M-03.....Zinc-coated (Galvanized) Carbon Steel Wire
  - A653/A653M-07.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process
  - C423-07.....Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
  - C634-02 (E2007).....Standard Terminology Relating to Environmental Acoustics
  - C635-04.....Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

C636-06.....	Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
E84-07.....	Surface Burning Characteristics of Building Materials
E119-07.....	Fire Tests of Building Construction and Materials
E413-04.....	Classification for Rating Sound Insulation.
E580-06.....	Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint
E1264-(R2005).....	Classification for Acoustical Ceiling Products

**PART 2- PRODUCTS**

**2.1 METAL SUSPENSION SYSTEM**

- A. ASTM C635, heavy-duty system, except as otherwise specified.
  - 1. Ceiling suspension system members may be fabricated from either of the following unless specified otherwise.
    - a. Galvanized cold-rolled steel, bonderized.
    - b. Extruded aluminum.
  - 2. Use same construction for cross runners as main runners. Use of lighter-duty sections for cross runners is not acceptable.
- B. Exposed grid suspension system for support of lay-in panels:
  - 1. Exposed grid width not less than 22 mm (7/8 inch) with not less than 8 mm (5/16 inch) panel bearing surface.
  - 2. Fabricate wall molding and other special molding from the same material with same exposed width and finish as the exposed grid members.
  - 3. On exposed metal surfaces apply baked-on enamel flat texture finish in color to match adjacent acoustical units.

**2.2 PERIMETER SEAL**

- A. Vinyl, polyethylene or polyurethane open cell sponge material having density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.
- B. Thickness as required to fill voids between back of wall molding and finish wall.
- C. Not less than 9 mm (3/8 inch) wide strip.

**2.3 WIRE**

- A. ASTM A641.
- B. For wire hangers: Minimum diameter 2.68 mm (0.1055 inch).
- C. For bracing wires: Minimum diameter 3.43 mm (0.1350 inch).

**2.4 ANCHORS AND INSERTS**

- A. Use anchors or inserts to support twice the loads imposed by hangers attached thereto.
- B. Clips:
  - 1. Galvanized steel.
  - 2. Designed to clamp to steel beam or bar joists, or secure framing member together.
  - 3. Designed to rigidly secure framing members together.
  - 4. Designed to sustain twice the loads imposed by hangers or items supported.

**2.5 CARRYING CHANNELS FOR SECONDARY FRAMING**

- A. Fabricate from cold-rolled or hot-rolled steel, black asphaltic paint finish, free of rust.
- B. Weighing not less than the following, per 300 m (per thousand linear feet):

Size mm	Size Inches	Cold-rolled		Hot-rolled	
		Kg	Pound	Kg	Pound
38	1 1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

**2.6 ACOUSTICAL UNITS**

- A. General:
  - 1. Ceiling Tile shall meet minimum 37% bio-based content in accordance with USDA Bio-Preferred Product requirements.
  - 2. ASTM E1264, weighing 3.6 kg/m<sup>2</sup> (3/4 psf) minimum for mineral fiber panels or tile.
  - 3. Class A Flame Spread: ASTM 84
  - 4. Minimum NRC (Noise Reduction Coefficient): 0.55 unless specified otherwise: ASTM C423.
  - 5. Minimum CAC (Ceiling Attenuation Class): 40-44 range unless specified otherwise: ASTM E413.
  - 6. Manufacturers standard finish, minimum Light Reflectance (LR) coefficient of 0.75 on the exposed surfaces.
  - 7. Lay-in panels: Sizes as shown, with square edges.
- B. Type III Units - Mineral base with water-based painted finish less than 10 g/l VOC, Form 2 - Water felted, minimum 16 mm (5/8 inch) thick. Mineral base to contain minimum 65 percent recycled content.

## 2.7 ACCESS IDENTIFICATION

- A. Markers:
1. Use colored markers with pressure sensitive adhesive on one side.
  2. Make colored markers of paper or plastic, 6 to 9 mm (1/4 to 3/8 inch) in diameter.
- B. Use markers of the same diameter throughout building.
- C. Color Code: Use following color markers for service identification:
- | Color.....  | Service                                  |
|-------------|--|
| Red.....    | Sprinkler System: Valves and Controls    |
| Green.....  | Domestic Water: Valves and Controls      |
| Yellow..... | Chilled Water and Heating Water          |
| Orange..... | Ductwork: Fire Dampers                   |
| Blue.....   | Ductwork: Dampers and Controls           |
| Black.....  | Gas: Laboratory, Medical, Air and Vacuum |

## PART 3 EXECUTION

### 3.1 CEILING TREATMENT

- A. Treatment of ceilings shall include sides and soffits of ceiling beams, furred work 600 mm (24 inches) wide and over, and vertical surfaces at changes in ceiling heights unless otherwise shown. Install acoustic tiles after wet finishes have been installed and solvents have cured.
- B. Lay out acoustical units symmetrically about center lines of each room or space unless shown otherwise on reflected ceiling plan.
- C. Moldings:
1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
  2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.
- D. Perimeter Seal:
1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
  2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.
- E. Existing ceiling:
1. Where extension of existing ceilings occur, match existing.
  2. Where acoustical units are salvaged and reinstalled or joined, use salvaged units within a space. Do not mix new and salvaged units within a space which results in contrast between old and new acoustic units.

3. Comply with specifications for new acoustical units for new units required to match appearance of existing units.

F. Fire-Rated System:

1. Total assembly, consisting of the ceiling suspension system, acoustical units, penetrations, structural components and floor or roof construction above, shall have a fire rating matching existing ceilings in the same location. Fire rating shall be based on tests conducted in conformance with ASTM E119.
2. Provide concealed fire protection around penetrations in ceilings for electric and mechanical work, and other penetrations as required to maintain the integrity of the fire-rated assembly.
3. Install fire rated ceiling systems to conform to tested assembly.

**3.2 CEILING SUSPENSION SYSTEM INSTALLATION**

A. General:

1. Install metal suspension system for acoustical tile and lay-in panels in accordance with ASTM C636, except as specified otherwise.
2. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
3. Support a maximum area of 1.48 m<sup>2</sup> (16 sf) of ceiling per hanger.
4. Prevent deflection in excess of 1/360 of span of cross runner and main runner.
5. Provide extra hangers, minimum of one hanger at each corner of each item of mechanical, electrical and miscellaneous equipment supported by ceiling suspension system not having separate support or hangers.
6. Provide not less than 100 mm (4 inch) clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit, secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown,
7. Use main runners not less than 1200 mm (48 inches) in length.
8. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

B. Direct Hung Suspension System:

1. As illustrated in ASTM C635.
2. Support main runners by hanger wires attached directly to the structure overhead.
3. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.

C. Indirect Hung Suspension System:

1. As illustrated in ASTM C635.
2. Space carrying channels for indirect hung suspension system not more than 1200 mm (4 feet) on center. Space hangers for carrying channels not more than 2400 mm (8 feet) on center or for carrying channels less than 1200 mm (4 feet) on center so as to insure that specified requirements are not exceeded.
3. Support main runners by specially designed clips attached to carrying channels.

**3.3 ACOUSTICAL UNIT INSTALLATION**

- A. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.
- B. Install lay-in acoustic panels in exposed grid with not less than 6 mm (1/4 inch) bearing at edges on supports.
  1. Install tile to lay level and in full contact with exposed grid.
  2. Replace cracked, broken, stained, dirty, or tile not cut for minimum bearing.
- C. Tile in concealed grid upward access suspension system:
  1. Install acoustical tile with joints close, straight and true to line, and with exposed surfaces level and flush at joints.
  2. Make corners and arises full, and without worn or broken places.
  3. Locate acoustical units providing access as specified under Article, ACCESS.
- D. Markers:
  1. Install markers of color code specified to identify the various concealed piping, mechanical, and plumbing systems.
  2. Attach colored markers to exposed grid on opposite sides of the units providing access.

**3.4 CLEAN-UP AND COMPLETION**

- A. Replace damaged, discolored, dirty, cracked and broken acoustical units.
- B. Leave finished work free from defects.

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**SECTION 09 65 13  
RESILIENT BASE AND ACCESSORIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

A. This section specifies the installation of vinyl or rubber base.

**1.2 RELATED WORK**

A. Color and texture: Section 09 06 00, SCHEDULE FOR FINISHESS.

B. Integral base with sheet flooring: Section  
SECTION 09 65 19 RESILIENT TILE FLOORING

**1.3 SUBMITTALS**

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT  
DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.
2. Base manufacturer's recommendations for adhesives.
3. Application and installation instructions.

C. Samples:

1. Base: 150 mm (6 inches) long, each type and color.
2. Sheet Rubber Flooring: 300 mm (12 inches) square.
3. Adhesive: Literature indicating each type.

**1.4 DELIVERY**

A. Deliver materials to the site in original sealed packages or  
containers, clearly marked with the manufacturer's name or brand, type  
and color, production run number and date of manufacture.

B. Materials from containers which have been distorted, damaged or opened  
prior to installation will be rejected.

**1.5 STORAGE**

A. Store materials in weather tight and dry storage facility.

B. Protect material from damage by handling and construction operations  
before, during, and after installation.

**1.6 APPLICABLE PUBLICATIONS**

A. The publication listed below form a part of this specification to the  
extent referenced. The publications are referenced in the text by the  
basic designation only.

B. American Society for Testing and Materials (ASTM):  
F1861-08.....Resilient Wall Base

C. Federal Specifications (Fed. Spec.):

RR-T-650E.....Treads, Metallic and Non-Metallic, Nonskid

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Use only products by the same manufacturer and from the same production run.

**2.2 RESILIENT BASE**

- A. ASTM F1861, 3 mm (1/8 inch) thick, 100 mm (4 inches) high, Thermoplastics, Group 2-layered. Style B-cove.
- B. Where carpet occurs, use Style A-straight.
- C. Use only one type of base throughout.

**2.3 ADHESIVES**

- A. Use products recommended by the material manufacturer for the conditions of use.
- B. Use low-VOC adhesive during installation. Water based adhesive with low VOC is preferred over solvent based adhesive.

**PART 3 - EXECUTION**

**3.1 PROJECT CONDITIONS**

- A. Maintain temperature of materials above 21° C (70 °F), for 48 hours before installation.
- B. Maintain temperature of rooms where work occurs, between 21° C and 27° C (70°F and 80°F) for at least 48 hours, before, during, and after installation.
- C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.

**3.2 INSTALLATION REQUIREMENTS**

- A. The respective manufacturer's instructions for application and installation will be considered for use when approved by the COR.
- B. Submit proposed installation deviation from this specification to the COR indicating the differences in the method of installation.
- C. The COR reserves the right to have test portions of material installation removed to check for non-uniform adhesion and spotty adhesive coverage.

**3.3 PREPARATION**

- A. Examine surfaces on which material is to be installed.
- B. Fill cracks, pits, and dents with leveling compound.
- C. Level to 3 mm (1/8 inch) maximum variations.

- D. Do not use adhesive for leveling or filling.
- E. Grind, sand, or cut away protrusions; grind high spots.
- F. Clean substrate area of oil, grease, dust, paint, and deleterious substances.
- G. Substrate area dry and cured. Perform manufacturer's recommended bond and moisture test.
- H. Preparation of existing installation:
  - 1. Remove existing base including adhesive.
  - 2. Do not use solvents to remove adhesives.
  - 3. Prepare substrate as specified.

### **3.4 BASE INSTALLATION**

- A. Location:
  - 1. Unless otherwise specified or shown, where base is scheduled, install base over toe space of base of casework, lockers, laboratory, pharmacy furniture island cabinets and where other equipment occurs.
  - 2. Extend base scheduled for room into adjacent closet, alcoves, and around columns.
- B. Application:
  - 1. Apply adhesive uniformly with no bare spots.
  - 2. Set base with joints aligned and butted to touch for entire height.
  - 3. Before starting installation, layout base material to provide the minimum number of joints with no strip less than 600 mm (24 inches) length.
    - a. Short pieces to save material will not be permitted.
    - b. Locate joints as remote from corners as the material lengths or the wall configuration will permit.
- C. Form corners and end stops as follows:
  - 1. Score back of outside corner.
  - 2. Score face of inside corner and notch cove.
- D. Roll base for complete adhesion.

### **3.5 CLEANING AND PROTECTION**

- A. Clean all exposed surfaces of base and adjoining areas of adhesive spatter before it sets.
- B. Clean and polish materials in the following order:

1. After two weeks, scrub resilient base with a minimum amount of water and a mild detergent. Leave surfaces clean and free of detergent residue. Polish resilient base to a gloss finish.
- c. Immediately prior to acceptance, replace damaged materials and re-clean resilient materials. Damaged materials are defined as having cuts, gouges, scrapes or tears and not fully adhered.

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**SECTION 09 65 19**  
**RESILIENT TILE FLOORING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. This section specifies the installation of vinyl composition tile and accessories required for a complete installation.

**1.2 RELATED WORK:**

- A. Resilient Base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Description of each product.
  - 2. Resilient material manufacturer's recommendations for adhesives, underlayment, primers, and polish.
  - 3. Application, installation and maintenance instructions.
- C. Shop Drawings:
  - 1. Layout of patterns as shown on the construction documents.
  - 2. Edge strip locations showing types and detail cross sections.
- D. Test Reports:
  - 1. Abrasion resistance: Depth of wear for each tile type and color and volume loss of tile, certified by independent laboratory. Tested per ASTM F510/F510M.

**1.4 DELIVERY:**

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation are not acceptable.

**1.5 STORAGE:**

- A. Store materials in a clean, dry, enclosed space off the ground, protected from harmful weather conditions and at temperature and humidity conditions recommended by the manufacturer. Protect adhesives from freezing. Store flooring, adhesives, and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

**1.6 QUALITY ASSURANCE:**

- A. Installer Qualifications: A company specializing in installation with minimum three (3) years' experience and employs experienced flooring installers who have retained, and currently hold, an INSTALL Certification, or a certification from a comparable certification program.
  - 1. Installers to be certified by INSTALL or a comparable certification program with the following minimum criteria:
    - a. US Department of Labor approved four (4) year apprenticeship program, 160 hours a year.
    - b. Career long training.
    - c. Manufacturer endorsed training.
    - d. Fundamental journeyman skills certification.
- B. Furnish product type materials from the same production run.

**1.7 WARRANTY:**

- A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".

**1.8 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. ASTM International (ASTM):
  - D2047-11.....Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
  - D2240-05(R2010).....Test Method for Rubber Property—Durometer Hardness
  - D4078-02(R2008).....Water Emulsion Floor Finish
  - E648-14c.....Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source
  - E662-14.....Specific Optical Density of Smoke Generated by Solid Materials
  - E1155/E1155M-14.....Determining Floor Flatness and Floor Levelness Numbers
  - F510/F510M-14.....Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with a Grit Feed Method

- F710-11.....Preparing Concrete Floors to Receive Resilient  
Flooring
- F925-13.....Test Method for Resistance to Chemicals of  
Resilient Flooring
- F1066-04(R2014).....Vinyl Composition Floor Tile
- F1344-12(R2013).....Rubber Floor Tile
- F1700-13a.....Solid Vinyl Floor Tile
- F1869-11.....Test Method for Measuring Moisture Vapor  
Emission Rate of Concrete Subfloor Using  
Anhydrous Calcium Chloride
- F2170-11.....Test Method for Determining Relative Humidity  
in Concrete Floor Slabs Using in Situ Probes
- F2195-13.....Linoleum Floor Tile
- C. Code of Federal Regulation (CFR):
- 40 CFR 59.....Determination of Volatile Matter Content, Water  
Content, Density Volume Solids, and Weight  
Solids of Surface Coating
- D. International Standards and Training Alliance (INSTALL):

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS:**

- A. Provide adhesives, underlayment, primers, and polish recommended by resilient floor material manufacturer.
- B. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E648.
- C. Smoke Density: Less than 450 per ASTM E662.
- D. Slip Resistance - Not less than 0.5 when tested with ASTM D2047.

**2.2 VINYL COMPOSITION TILE:**

- A. Tile Standard: ASTM F1066, Class 2, through-pattern tile.
- B. Wearing Surface: Smooth
- C. Thickness: 3.2 mm (0.125 inch)
- D. Size: 305 x 305 mm (12 x 12 inches)

**2.3 ADHESIVES:**

- A. Provide water resistant type adhesive for flooring, base and accessories as recommended by the manufacturer to suit substrate conditions. Submit manufacturer's descriptive data, documentation stating physical characteristics, and mildew and germicidal characteristics.

**2.4 LEVELING COMPOUND FOR CONCRETE FLOORS:**

- A. Provide cementitious products with latex or polyvinyl acetate resins in the mix.

**2.5 POLISH AND CLEANERS:**

- A. Cleaners: As recommended in writing by floor tile manufacturer.
- B. Polish: ASTM D4078.

**PART 3 - EXECUTION**

**3.1 ENVIRONMENTAL REQUIREMENTS:**

- A. Maintain flooring materials and areas to receive resilient flooring at a temperature above 20 degrees C (68 degrees F) for three (3) days before application, during application and two (2) days after application, unless otherwise directed by the flooring manufacturer for the flooring being installed. Maintain a minimum temperature of 13 degrees C (55 degrees F) thereafter. Provide adequate ventilation to remove moisture from area and to comply with regulations limiting concentrations of hazardous vapors.
- B. Do not install flooring until building is permanently enclosed and wet construction in or near areas to receive tile materials is complete, dry and cured.

**3.2 SUBFLOOR TESTING AND PREPARATION:**

- A. Prepare and test surfaces to receive resilient tile and adhesive
  - 1. Remove existing resilient floor and existing adhesive.
- B. Prepare concrete substrates in accordance with ASTM F710.

**3.3 INSTALLATION:**

- A. Install in accordance with manufacturer's instructions for application and installation unless specified otherwise.
- B. Mix tile from at least two containers. An apparent line either of shades or pattern variance is not acceptable.
- C. Tile Layout:
  - 1. If layout is not shown on construction documents, lay tile symmetrically about center of room or space with joints aligned.
  - 2. Vary edge width as necessary to maintain full size tiles in the field, no edge tile to be less than 1/2 the field tile size, except where irregular shaped rooms make it impossible.
  - 3. Place tile pattern in the same direction; do not alternate tiles unless specifically indicated in the construction documents to the contrary.



D. Application:

1. Adhere floor tile to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
2. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
3. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
4. Roll tile floor with a minimum 45 kg (100 pound) roller.

E. Seal joints at pipes with sealants in accordance with Section 07 92 00, JOINT SEALANTS.

F. Installation of Edge Strips:

1. Locate edge strips under center line of doors unless otherwise shown on construction documents.
2. Set resilient edge strips in adhesive. Anchor metal edge strips with anchors and screws.
3. Where tile edge is exposed, butt edge strip to touch along tile edge.
4. Where thin set ceramic tile abuts resilient tile, set edge strip against floor file and against the ceramic tile edge.

**3.4 CLEANING AND PROTECTION:**

- A. Clean adhesive marks on exposed surfaces during the application of resilient materials before the adhesive sets. Exposed adhesive is not acceptable.
- B. Keep traffic off resilient material for a minimum 72 hours after installation.
- C. Clean flooring as recommended in accordance with manufacturer's printed maintenance instructions and within the recommended time frame. As required by the manufacturer, apply the recommended number of coats and type of polish and/or finish in accordance with manufacturer's written instructions.
- D. When construction traffic occurs over tile, cover resilient materials with reinforced kraft paper properly secured and maintained until removal is directed by COR. At entrances and where wheeled vehicles or

carts are used, cover tile with plywood, hardboard, or particle board over paper, secured and maintained until removal is directed by COR.

- E. When protective materials are removed and immediately prior to acceptance, replace damaged tile and mouldings, re-clean resilient materials.

**3.5 LOCATION:**

- A. Unless otherwise indicated in construction documents, install tile flooring, under areas where casework, laboratory and pharmacy furniture and other equipment occur.
- B. Extend tile flooring for room into adjacent closets and alcoves.

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**SECTION 09 66 16**  
**TERRAZZO FLOOR TILE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. This section specifies requirements for terrazzo tile for installation ON THE FLOORS OF THE NEW ELEVATOR CARS.

**1.2 RELATED WORK:**

- A. Resilient Base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.
- B. Subfloor Testing and Preparation: Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES.

**1.3 QUALITY ASSURANCE:**

- A. Approval by Contracting Officer Representative (COR) is required of products or service, or proposed manufacturer, suppliers and installers, and will be based upon submission by Contractor of certification that:
  - 1. Manufacturer has manufactured terrazzo tile as one of his principal products for a minimum of three (3) years. Submit list of not less than five (5) installations. List is to include name of project, and owner and location of project. Submit manufacturer's qualifications.
  - 2. Installer has installed terrazzo tile for a minimum of three (3) years. Submit installer's qualifications.

**1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Flooring Manufacturer's Literature and Data: Printed pre-installation and installation instructions for conditions indicated.
- C. Certificates: Indicating materials conform to specified requirements. Indicating flooring manufacturer's approval of underlayment, substrate preparation, adhesive finishes and cleaners.
- D. Samples: Terrazzo Tile each color, size, finish, and type to be used.
- E. Installer's qualifications.
- F. Manufacturer's warranty.

**1.5 DELIVERY:**

- A. Deliver materials to job in manufacturer's original unopened containers, free of damage, with manufacturer's brand name marked thereon.

**1.6 STORAGE:**

- A. Store materials in a protected area. That is kept dry and has a temperature not lower than 18 degrees C (65 degrees F) or higher than 27 degrees C (80 degrees F).

**1.7 PROJECT CONDITIONS:**

- A. Do not install tiles until all other work that could cause damage to the finish flooring has been completed. Acclimate tiles and maintain spaces where tile is to be installed to a temperature of not less than 21 degrees C (70 degrees F) for at least 48 hours before, during and after the installation of tiles. A minimum temperature of 13 degrees C (55 degrees F) is to be maintained thereafter.

**1.8 WARRANTY:**

- A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".

**1.9 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. ASTM International (ASTM):
  - C97/C97M-09.....Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone
  - C109/C109M-13.....Compressive Strength of Hydraulic Cement Mortars
  - C501-84(R2009).....Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser
  - E84-14.....Test Method for Surface Burning Characteristics of Building Materials
  - E90-09.....Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Element
  - E413-10.....Classification for Rating Sound Insulation
  - E492-09.....Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine
  - E648-14c.....Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

E989-06.....Standard Classification for Determination of  
 Impact Insulation Class

F1869-11.....Test Method for Measuring Moisture Vapor  
 Emission Rate of Concrete Subfloor Using  
 Anhydrous Calcium Chloride

F2170-11.....Test Method for Determining Relative Humidity  
 in Concrete Floor Slabs Using in Situ Probes

C. Code of Federal Regulation (CFR):

40 CFR 59.....Determination of Volatile Matter Content, Water  
 Content, Density Volume Solids, and Weight  
 Solids of Surface Coating

D. Tile Council of North America (TCNA):

DCOF AcuTest-2012.....Dynamic Coefficient of Friction Test

**PART 2 - PRODUCTS**

**2.1 TERRAZZO TILE:**

A. Provide terrazzo tile that is Size:12" x 12" x 3/16" of color, finish and type as selected by the COR. Tiles are to consist of marble or granite chips embedded in a flexible thermoset resin matrix. Provide marble and granite chips that are manufacturer's standard gradation. Provide tile with the following properties.

TERRAZZO TILE PROPERTIES		
PROPERTY	TEST METHOD	VALUE
Compressive strength	ASTM C109/C109M	20 MPa (3000 psi) minimum
Water Absorption	ASTM C97/C97M	0.7 percent maximum
Abrasive Wear	ASTM C501	Index 28
Coefficient of Friction	TCNA DCOF AcuTest	0.42 when wet
Flame Spread	ASTM E84	Class A
Critical Radiant Flux	ASTM E648	Class I

**2.2 ADHESIVE:**

- A. Provide terrazzo tile manufacturer's standard product or a product recommended by the terrazzo tile manufacturer.

**2.3 NOT USED**

**2.4 TERRAZZO BASE/STRIPS:**

- A. Provide terrazzo base/strips matching the requirements of terrazzo tile and being a manufacturer's standard product. Color, size, thickness, finish and type to match floor tile selection.

**2.5 METAL EDGE STRIPS:**

- A. Extruded aluminum, butt-type, 38 mm (1-1/2 inches) wide with thickness to set top surface flush with top of tile and with bevel at exposed edge. Edge strips to have countersunk holes, within 12 mm (1/2 inch) of each end and spaced at no more than 203 mm (8 inches) on center for securement.

**PART 3 - EXECUTION**

**3.1 GENERAL:**

- A. Provide terrazzo tile flooring and base on floor surfaces and walls in the elevator passenger cars being upgraded in this project. After becoming familiar with details of the work, verify dimensions in the field, and advise the COR of any discrepancy before performing the work.

**3.2 INSTALLATION:**

- A. Install tile in accordance with the tile manufacturers approved installation instructions, except as specified herein. Lay design symmetrical about center lines of rooms. Joints are to be maximum 0.79 mm (1/32 inch) and in true alignment. Cut tile to fit snugly at pipes and other fixed vertical surfaces. Seal joints at pipes with silicone. Remove spots or smears of adhesive immediately. Make entire surfaces of finished tile floors smooth, straight, and free from bleeding adhesive, buckles, waves or projecting tile edges upon completion.
- B. Metal Edge Strips: Secure strips with No. 10 aluminum alloy, counter sunk flathead machine screws with expansion sleeves. Provide metal edge strips, in one (1) piece, at any exposed edges of tile.
- C. Terrazzo Base/Strips: Continuous and adhesively applied. Joints are to be tight and formed in same manner as floor tile.

**3.3 CLEANING:**

- A. Upon completion and after adhesive has cured, clean flooring in accordance with manufacturer's recommendations.

**3.4 PROTECTION:**

- A. From the time of laying until acceptance, protect the flooring from damage. Replace damaged, loose, broken, or curled tiles. Except as necessary to install new tile, keep all traffic off new tile for at least 24 hours after installation.

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**SECTION 09 91 00**  
**PAINTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the painting and finishing as shown on the construction documents and/or specified herein, including, but not limited to, the following:
1. Prime coats which may be applied in shop under other sections.
  2. Prime painting unprimed surfaces to be painted under this Section.
  3. Painting items furnished with a prime coat of paint, including touching up of or repairing of abraded, damaged or rusted prime coats applied by others.
  4. Painting ferrous metal (except stainless steel) exposed to view.
  5. Painting galvanized ferrous metals exposed to view.
  6. Painting gypsum drywall exposed to view.
  7. Painting of wood exposed to view, except items which are specified to be painted or finished under other Sections of these specifications. Back painting of all wood in contact with concrete, masonry or other moisture areas.
  8. Painting pipes, pipe coverings, conduit, ducts, insulation, hangers, supports and other mechanical and electrical items and equipment exposed to view.
  9. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers lighting fixtures, and the like, which are exposed to view through these items.
  10. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.
  11. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
  12. Painting of any surface not specifically mentioned to be painted herein or on construction documents, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, is to be included as though specified.



**1.2 RELATED WORK:**

- A. Shop prime painting of steel and ferrous metals: Division 08 - OPENINGS; Division 21 - FIRE SUPPRESSION; Division 22 - PLUMBING; Division 23 - HEATING; VENTILATION AND AIR-CONDITIONING; Division 26 - ELECTRICAL; Division 27 - COMMUNICATIONS; and Division 28 - ELECTRONIC SAFETY AND SECURITY sections.
- B. Type of Finish, Color, and Gloss Level of Finish Coat: Section 09 06 00, SCHEDULE FOR FINISHES.

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Painter qualifications.
- C. Manufacturer's Literature and Data:
  - 1. Before work is started, or sample panels are prepared, submit manufacturer's literature and technical data, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one (1) list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.
- E. Sample Panels:
  - 1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.
  - 2. Panels to Show Color: Composition board, 100 x 250 mm (4 x 10 inch).
  - 3. Panel to Show Transparent Finishes: Wood of same species and grain pattern as wood approved for use, 100 x 250 mm (4 x 10 inch face) minimum, and where both flat and edge grain will be exposed, 250 mm (10 inches) long by sufficient size, 50 x 50 mm (2 x 2 inch) minimum or actual wood member to show complete finish.
  - 4. Attach labels to panel stating the following:
    - a. Federal Specification Number or manufacturers name and product number of paints used.

- b. Specification code number specified in Section 09 06 00, SCHEDULE FOR FINISHES.
  - c. Product type and color.
  - d. Name of project.
5. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.
- F. Sample of identity markers if used.
- G. Manufacturers' Certificates indicating compliance with specified requirements:
- 1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
  - 2. Epoxy coating.

**1.4 DELIVERY AND STORAGE:**

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
- 1. Name of manufacturer.
  - 2. Product type.
  - 3. Batch number.
  - 4. Instructions for use.
  - 5. Safety precautions.
- B. In addition to manufacturer's label, provide a label legibly printed as following:
- 1. Federal Specification Number, where applicable, and name of material.
  - 2. Surface upon which material is to be applied.
  - 3. Specify Coat Types: Prime; body; finish; etc.
- C. Maintain space for storage, and handling of painting materials and equipment in a ventilated, neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 7 and 30 degrees C (45 and 85 degrees F).

**1.5 QUALITY ASSURANCE:**

- A. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. Submit evidence that key personnel have successfully performed surface preparation and application of coating on a minimum of three (3) similar projects within the past three (3) years.

B. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Contracting Officer Representative (COR) in writing of any anticipated problems using the coating systems as specified with substrates primed by others.

**1.6 REGULATORY REQUIREMENTS:**

- A. Paint materials are to conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
1. Volatile Organic Compounds (VOC) Emissions Requirements: Field-applied paints and coatings that are inside the waterproofing system to not exceed limits of authorities having jurisdiction.
  2. Lead-Base Paint:
    - a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
    - b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
    - c. Do not use coatings having a lead content over 0.06 percent by weight of non-volatile content.
    - d. For lead-paint removal, see Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
  3. Asbestos: Provide materials that do not contain asbestos.
  4. Chromate, Cadmium, Mercury, and Silica: Provide materials that do not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
  5. Human Carcinogens: Provide materials that do not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
  6. Use high performance acrylic paints in place of alkyd paints.

**1.7 SAFETY AND HEALTH**

- A. Apply paint materials using safety methods and equipment in accordance with the following:
  - 1. Comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis (AHA) as specified in Section 01 35 26, SAFETY REQUIREMENTS. The AHA is to include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.
- B. Safety Methods Used During Paint Application: Comply with the requirements of SSPC PA Guide 10.
- C. Toxic Materials: To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:
  - 1. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
  - 2. 29 CFR 1910.1000.
  - 3. ACHIH-BKLT and ACGHI-DOC, threshold limit values.

**1.8 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):
  - ACGIH TLV-BKLT-2012.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)
  - ACGIH TLV-DOC-2012.....Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)
- C. ASME International (ASME):
  - A13.1-07(R2013).....Scheme for the Identification of Piping Systems
- D. Code of Federal Regulation (CFR):
  - 40 CFR 59.....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating
- E. Commercial Item Description (CID):
  - A-A-1272A.....Plaster Gypsum (Spackling Compound)
- F. Federal Specifications (Fed Spec):

TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For  
Waterproofing Concrete and Masonry Walls) (CEP)

G. Master Painters Institute (MPI):

- 1.....Aluminum Paint
- 31.....Polyurethane, Moisture Cured, Clear Gloss
- 45.....Interior Primer Sealer
- 47.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5
- 50.....Interior Latex Primer Sealer
- 71.....Polyurethane, Moisture Cured, Clear, Flat
- 90.....Interior Wood Stain, Semi-Transparent
- 95.....Fast Drying Metal Primer
- 134.....Galvanized Water Based Primer
- 139.....Interior High Performance Latex, MPI Gloss Level 3

G. Society for Protective Coatings (SSPC):

- SSPC SP 1-82(R2004).....Solvent Cleaning
- SSPC SP 2-82(R2004).....Hand Tool Cleaning
- SSPC SP 3-28(R2004).....Power Tool Cleaning
- SSPC SP 10/NACE No.2.....Near-White Blast Cleaning
- SSPC PA Guide 10.....Guide to Safety and Health Requirements

H. Maple Flooring Manufacturer's Association (MFMA):

I. U.S. National Archives and Records Administration (NARA):

- 29 CFR 1910.1000.....Air Contaminants

J. Underwriter's Laboratory (UL)

**PART 2 - PRODUCTS**

**2.1 MATERIALS:**

- A. Conform to the coating specifications and standards referenced in PART 3.  
Submit manufacturer's technical data sheets for specified coatings and solvents.

**2.2 PAINT PROPERTIES:**

- A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.
- B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

- C. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only to recommended limits.
- D. VOC Content: For field applications that are inside the weatherproofing system, paints and coating to comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
  - 1. Flat Paints and Coatings: 50 g/L.
  - 2. Non-flat Paints and Coatings: 150 g/L.
  - 3. Dry-Fog Coatings: 400 g/L.
  - 4. Primers, Sealers, and Undercoaters: 200 g/L.
  - 5. Anticorrosive and Antirust Paints applied to Ferrous Metals: 250 g/L.
  - 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
  - 7. Pretreatment Wash Primers: 420 g/L.
  - 8. Shellacs, Clear: 730 g/L.
  - 9. Shellacs, Pigmented: 550 g/L.
- E. VOC test method for paints and coatings is to be in accordance with 40 CFR 59 (EPA Method 24). Part 60, Appendix A with the exempt compounds' content determined by Method 303 (Determination of Exempt Compounds) in the South Coast Air Quality Management District's (SCAQMD) "Laboratory Methods of Analysis for Enforcement Samples" manual.

**2.3 PLASTIC TAPE:**

- A. Pigmented vinyl plastic film in colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES or specified.
- B. Pressure sensitive adhesive back.
- C. Snap on coil plastic markers.
- D. Widths as shown on construction documents.

**PART 3 - EXECUTION**

**3.1 JOB CONDITIONS:**

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
  - 1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
  - 2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each day's work.
- B. Atmospheric and Surface Conditions:

1. Do not apply coating when air or substrate conditions are:
  - a. Less than 3 degrees C (5 degrees F) above dew point.
  - b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the COR and the product manufacturer. Under no circumstances are application conditions to exceed manufacturer recommendations.
  - c. When the relative humidity exceeds 85 percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.
2. Maintain interior temperatures until paint dries hard.
3. Apply only on clean, dry and frost free surfaces except as follows:
  - a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces only when allowed by manufacturer's printed instructions.
  - b. Concrete and masonry when permitted by manufacturer's recommendations, dampen surfaces to which water thinned acrylic and cementitious paints are applied with a fine mist of water on hot dry days to prevent excessive suction and to cool surface.
4. Varnishing:
  - a. Apply in clean areas and in still air.
  - b. Before varnishing vacuum and dust area.
  - c. Immediately before varnishing wipe down surfaces with a tack rag.

### **3.2 INSPECTION:**

- A. Examine the areas and conditions where painting and finishing are to be applied and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

### **3.3 GENERAL WORKMANSHIP REQUIREMENTS:**

- A. Application may be by brush or roller. Spray application only upon acceptance from the COR in writing.
- B. Furnish to the COR a painting schedule indicating when the respective coats of paint for the various areas and surfaces will be completed. This schedule is to be kept current as the job progresses.
- C. Protect work at all times. Protect all adjacent work and materials by suitable covering or other method during progress of work. Upon completion of the work, remove all paint and varnish spots from floors, glass and other surfaces. Remove from the premises all rubbish and accumulated

materials of whatever nature not caused by others and leave work in a clean condition.

- D. Remove and protect hardware, accessories, device plates, lighting fixtures, and factory finished work, and similar items, or provide in place protection. Upon completion of each space, carefully replace all removed items by workmen skilled in the trades involved.
- E. When indicated to be painted, remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.
- F. Materials are to be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.
- G. Apply materials with a coverage to hide substrate completely. When color, stain, dirt or undercoats show through final coat of paint, the surface is to be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage, at no additional cost to the Government.
- H. All coats are to be dry to manufacturer's recommendations before applying succeeding coats.

#### **3.4 SURFACE PREPARATION:**

- A. General:
  - 1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished are to be completely dry, clean and smooth.
  - 2. See other sections of specifications for specified surface conditions and prime coat.
  - 3. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
  - 4. Clean surfaces before applying paint or surface treatments with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry. Schedule the cleaning



- and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.
5. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
    - a. Concrete: 12 percent.
    - b. Fiber-Cement Board: 12 percent.
    - c. Wood: 15 percent.
    - d. Gypsum Board: 12 percent.
- B. Wood:
1. Sand to a smooth even surface and then dust off.
  2. Sand surfaces showing raised grain smooth between each coat.
  3. Wipe surface with a tack rag prior to applying finish.
  4. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
  6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
  7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.
    - a. Thin filler in accordance with manufacturer's instructions for application.
    - b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.
- C. Ferrous Metals:
1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
  2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning).
  3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel door frames, access panels and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.

- a. Fill flat head countersunk screws used for permanent anchors.
  - b. Do not fill screws of item intended for removal such as glazing beads.
4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
  5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.
- D. Zinc-Coated (Galvanized) Metal Surfaces Specified Painted:
1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
  2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non-Cementitious Galvanized Primer) depending on finish coat compatibility.
- E. Concrete, Cement Board, :
1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
  2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
  3. Neutralize Concrete floors to be painted by washing with a solution of 1.4 Kg (3 pounds) of zinc sulfate crystals to 3.8 L (1 gallon) of water, allow to dry three (3) days and brush thoroughly free of crystals.
  4. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces Remove projections to level of adjacent surface by grinding or similar methods.
- F. Gypsum Board:
1. Remove efflorescence or finishing materials.
  2. Remove dust, dirt, and other deterrents to paint adhesion.
  3. Fill holes, cracks, and other depressions with CID-A-A-1272A finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

**3.5 PAINT PREPARATION:**

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two (2) component and two (2) part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

**3.6 APPLICATION:**

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three (3) coats; prime, body, and finish. When two (2) coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.
- D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by COR.
- E. Apply by brush or roller. Spray application for existing occupied spaces only upon approval by acceptance from COR in writing.
  - 1. Apply painting materials specifically required by manufacturer to be applied by spraying.
  - 2. In new construction and in existing occupied spaces, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in "Building and Structural Work Field Painting"; "Work not Painted"; motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.
- F. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

**3.7 PRIME PAINTING:**

- A. After surface preparation, prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required.
- E. Wood and Wood Particleboard:
  - 1. Use same kind of primer specified for exposed face surface.
    - a. Transparent finishes as specified under "Transparent Finishes on Wood Except Floors Article".
- F. Metals except boilers, incinerator stacks, and engine exhaust pipes:
  - 1. Steel and iron: MPI 95 (Fast Drying Metal Primer).
  - 2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer) .
- G. Gypsum Board (Except Operating Rooms):
  - 1. Primer: MPI 50 (Interior Latex Primer Sealer).

**3.8 NOT USED**

**3. INTERIOR FINISHES:**

- A. Apply following finish coats over prime coats in spaces or on surfaces specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. Metal Work:
  - 1. Apply to exposed surfaces.
  - 2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
  - 3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
    - a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) unless specified otherwise.
- C. Gypsum Board (Except Operating Rooms):
  - 1. One (1) coat of MPI 45 (Interior Primer Sealer) plus one (1) coat of MPI 139 (Interior High Performance Latex, MPI Gloss level 3).
- F. Wood:
  - 1. Sanding:
    - a. Use 220-grit sandpaper.
    - b. Sand sealers and varnish between coats.

c. Sand enough to scarify surface to assure good adhesion of subsequent coats, to level roughly applied sealer and varnish, and to knock off "whiskers" of any raised grain as well as dust particles.

2. Sealers:

a. MPI 31 (gloss) or MPI 71 (flat) thinned as recommended by manufacturer at rate of one (1) part of thinner to four (4) parts of varnish.

b. Apply sealers specified except sealer may be omitted where pigmented, penetrating, or wiping stains containing resins are used.

c. Allow manufacturer's recommended drying time before sanding, but not less than 24 hours or 36 hours in damp or muggy weather.

d. Sand as specified.

4. Transparent Finishes on Wood Doors.

a. Stain Finish:

1) One (1) coat of MPI 90 (Interior Wood Stain, Semi-Transparent).

2) Use wood stain of type and color required to achieve finish specified. Do not use varnish type stains.

3) One (1) coat of sealer MPI 31 (gloss) thinned as recommended by manufacturer at rate of one (1) part of thinner to four (4) parts of varnish.

4) Two (2) coats of MPI 71 (Polyurethane, Moisture Cured, Clear Flat) .

H. Miscellaneous:

1. Apply where specified in Section 09 06 00, SCHEDULE FOR FINISHES.

**3.10 REFINISHING EXISTING PAINTED SURFACES:**

A. Clean, patch and repair existing surfaces as specified under "Surface Preparation". No "telegraphing" of lines, ridges, flakes, etc., through new surfacing is permitted. Where this occurs, sand smooth and re-finish until surface meets with COR's approval.

B. Remove and reinstall items as specified under "General Workmanship Requirements".

C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.

D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.

- E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
- F. In existing rooms and areas where alterations occur, clean existing stained and natural finished wood retouch abraded surfaces and then give entire surface one (1) coat of MPI 71 (Polyurethane, Moisture Cured, Clear Flat).
- G. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- H. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.
- I. Sand or dull glossy surfaces prior to painting.
- J. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

**3.11 PAINT COLOR:**

- A. Color and gloss of finish coats is specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. For additional requirements regarding color see Articles, "REFINISHING EXISTING PAINTED SURFACE" and "MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE".
- C. Coat Colors:
  - 1. Color of priming coat: Lighter than body coat.
  - 2. Color of body coat: Lighter than finish coat.
  - 3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.
- D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
  - 1. Paint to match color of casework where casework has a paint finish.
  - 2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

**3.12 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE:**

- A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.
- B. In spaces not scheduled to be finish painted in Section 09 06 00, SCHEDULE FOR FINISHES paint as specified below.
- C. Paint various systems specified in Division 02 - EXISTING CONDITIONS, Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 -

HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL,  
Division 27 - COMMUNICATIONS, and Division 28 - ELECTRONIC SAFETY AND  
SECURITY.

- D. Paint after tests have been completed.
- E. Omit prime coat from factory prime-coated items.
- F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.
- G. Omit field painting of items specified in "BUILDING AND STRUCTURAL WORK FIELD PAINTING"; "Building and Structural Work not Painted".
- H. Color:
  - 1. Paint items having no color specified in Section 09 06 00, SCHEDULE FOR FINISHES to match surrounding surfaces.
  - 2. Paint colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES except for following:
    - a. White: Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
    - b. Gray: Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
    - c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
    - d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
    - e. Federal Safety Orange: Entire lengths of electrical conduits containing feeders 600 volts or more.
    - f. Color to match brickwork sheet metal covering on breeching outside of exterior wall of boiler house.

I. Apply paint systems on properly prepared and primed surface as follows:

2. Interior Locations:

a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) to following items:

1) Metal under 94 degrees C (201 degrees F) of items such as bare piping, fittings, hangers and supports.

2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.

3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.

b. Paint electrical conduits containing cables rated 600 volts or more using two (2) coats of MPI 94 (Exterior Alkyd, Semi-gloss) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.

3. Other exposed locations:

a. Metal surfaces, except aluminum, of cooling towers exposed to view, including connected pipes, rails, and ladders: Two (2) coats of MPI 1 (Aluminum Paint).

b. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: One (1) coat of MPI 50 (Interior Latex Primer Sealer) and one (1) coat of MPI 11 (Exterior Latex Semi-Gloss).

**3.13 BUILDING AND STRUCTURAL WORK FIELD PAINTING:**

A. Painting and finishing of interior work except as specified here-in-after.

1. Painting and finishing of new and existing work including colors and gloss of finish selected is specified in Finish Schedule, Section 09 06 00, SCHEDULE FOR FINISHES.

2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.

3. Painting of ferrous metal and galvanized metal.

4. Identity painting and safety painting.

B. Building and Structural Work not Painted:

1. Prefinished items:



- a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.
  - b. Factory finished equipment.
2. Finished surfaces:
- a. Hardware except ferrous metal.
  - b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
  - c. Signs, fixtures, and other similar items integrally finished.
3. Concealed surfaces:
- a. Inside dumbwaiter, elevator and duct shafts, interstitial spaces, above ceilings, attics, except as otherwise specified.
  - b. Inside walls or other spaces behind access doors or panels.
  - c. Surfaces concealed behind permanently installed casework and equipment.
4. Moving and operating parts:
- a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
  - b. Tracks for overhead or coiling doors, shutters, and grilles.
5. Labels:
- a. Code required label, such as Underwriters Laboratories Inc., Intertek Testing Service or Factory Mutual Research Corporation.
  - b. Identification plates, instruction plates, performance rating, and nomenclature.
6. Galvanized metal:
- a. Except where specifically specified to be painted.
7. Metal safety treads and nosings.
8. Gaskets.

**3.14 IDENTITY PAINTING SCHEDULE:**

- A. Identify designated service in new buildings or projects with extensive remodeling in accordance with ASME A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels. For existing spaces where work is minor match existing.
1. Legend may be identified using snap-on coil plastic markers or by paint stencil applications.

2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 12.2 M (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
3. Locate Legends clearly visible from operating position.
4. Use arrow to indicate direction of flow using black stencil paint.
5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on construction documents where asterisk appears for High, Medium, and Low Pressure designations as follows:
  - a. High Pressure - 414 kPa (60 psig) and above.
  - b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
  - c. Low Pressure - 103 kPa (14 psig) and below.
  - d. Add Fuel oil grade numbers.
6. Legend name in full or in abbreviated form as follows:

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND ABBREVIATIONS
Hot Water Heating Supply		Green	White	H. W. Htg Sup
Hot Water Heating Return		Green	White	H. W. Htg Ret
Pump Recirculating		Green	White	Pump-Recirc.
Cold Water (Domestic)	White	Green	White	C.W. Dom
Hot Water (Domestic)				
Supply	White	Yellow	Black	H.W. Dom
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Yellow	Black	Temp. Wtr
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent

7. Electrical Conduits containing feeders over 600 volts, paint legends using 50 mm (2 inch) high black numbers and letters, showing the voltage class rating. Provide legends where conduits pass through walls and floors and at maximum 6096 mm (20 foot) intervals in between. Use labels with yellow background with black border and words Danger High Voltage.
8. See Sections for methods of identification, legends, and abbreviations of the following:

- a. Regular compressed air lines: Section 22 15 00, GENERAL SERVICE COMPRESSED-AIR SYSTEMS.
  - b. Dental compressed air lines: Section 22 61 13.74, DENTAL COMPRESSED-AIR PIPING / Section 22 61 19.74, DENTAL COMPRESSED-AIR EQUIPMENT.
  - c. Laboratory gas and vacuum lines: Section 22 62 00, VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES / Section 22 63 00, GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES.
  - d. Oral evacuation lines: Section 22 62 19.74, DENTAL VACUUM AND EVACUATION EQUIPMENT.
  - e. Medical Gases and vacuum lines: Section 22 62 00, VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES / Section 22 63 00, GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES.
  - f. Conduits containing high voltage feeders over 600 volts:  
Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS /  
Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS /  
Section 28 05 33, RACEWAYS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY.
- B. Fire and Smoke Partitions:
1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
  2. Stenciled message: "SMOKE BARRIER" or, "FIRE BARRIER" as applicable.
  3. Locate not more than 6096 mm (20 feet) on center on corridor sides of partitions, and with a least one (1) message per room on room side of partition.
  4. Use semi-gloss paint of color that contrasts with color of substrate.
- C. Identify columns in pipe basements and interstitial space:
1. Apply stenciled number and letters to correspond with grid numbering and lettering indicated on construction documents.
  2. Paint numbers and letters 101 mm (4 inches) high, locate 45 mm (18 inches) below overhead structural slab.
  3. Apply on four (4) sides of interior columns and on inside face only of exterior wall columns.
  4. Color:
    - a. Use black on concrete columns.
    - b. Use white or contrasting color on steel columns.

**3.15 PROTECTION CLEAN UP, AND TOUCH-UP:**

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

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**SECTION 13 05 41**  
**SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. Provide seismic restraint in accordance with the requirements of this section in order to maintain the integrity of nonstructural components of the building so that they remain safe and functional in case of seismic event.
- B. The design to resist seismic load shall be based on Seismic Design Categories per section 4.0 of the VA Seismic Design Requirements (H-18-8) dated August 2013, <http://www.cfm.va.gov/til/etc/seismic.pdf>.
- C. Definitions: Non-structural building components are components or systems that are not part of the building's structural system whether inside or outside, above or below grade. Non-structural components of buildings include:
  - 1. Architectural Elements: Facades that are not part of the structural system and its shear resistant elements; cornices and other architectural projections and parapets that do not function structurally; glazing; nonbearing partitions; suspended ceilings; stairs isolated from the basic structure; cabinets; bookshelves; medical equipment; and storage racks.
  - 2. Electrical Elements: Power and lighting systems; substations; switchgear and switchboards; auxiliary engine-generator sets; transfer switches; motor control centers; motor generators; selector and controller panels; fire protection and alarm systems; special life support systems; and telephone and communication systems.
  - 3. Mechanical Elements: Heating, ventilating, and air-conditioning systems; medical gas systems; plumbing systems; sprinkler systems; pneumatic systems; boiler equipment and components.
  - 4. Transportation Elements: Mechanical, electrical and structural elements for transport systems, i.e., elevators and dumbwaiters, including hoisting equipment and counterweights.

**1.2 QUALITY CONTROL:**

- A. Shop-Drawing Preparation:
  - 1. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. The professional structural engineer shall be registered in the state where the project is located.

2. Submit design tables and information used for the design-force levels, stamped and signed by a professional structural engineer registered in the State where project is located.

B. Coordination:

1. Do not install seismic restraints until seismic restraint submittals are approved by the Resident Engineer.
2. Coordinate and install trapezes or other multi-pipe hanger systems prior to pipe installation.

C. Seismic Certification:

In structures assigned to IBC Seismic Design Category C, D, E, or F, permanent equipments and components are to have Special Seismic Certification in accordance with requirements of section 13.2.2 of ASCE 7 except for equipment that are considered rugged as listed in section 2.2 OSHPD code application notice CAN No. 2-1708A.5, and shall comply with section 13.2.6 of ASCE 7.

**1.3 SUBMITTALS:**

A. Submit a coordinated set of equipment anchorage drawings prior to installation including:

1. Description, layout, and location of items to be anchored or braced with anchorage or brace points noted and dimensioned.
2. Details of anchorage or bracing at large scale with all members, parts brackets shown, together with all connections, bolts, welds etc. clearly identified and specified.
3. Numerical value of design seismic brace loads.
4. For expansion bolts, include design load and capacity if different from those specified.

B. Submit prior to installation, a coordinated set of bracing drawings for seismic protection of piping, with data identifying the various support-to-structure connections and seismic bracing structural connections, include:

1. Single-line piping diagrams on a floor-by-floor basis. Show all suspended piping for a given floor on the same plain.
2. Type of pipe (Copper, steel, cast iron, insulated, non-insulated, etc.).
3. Pipe contents.
4. Structural framing.
5. Location of all gravity load pipe supports and spacing requirements.
6. Numerical value of gravity load reactions.
7. Location of all seismic bracing.
8. Numerical value of applied seismic brace loads.

9. Type of connection (Vertical support, vertical support with seismic brace etc.).
  10. Seismic brace reaction type (tension or compression): Details illustrating all support and bracing components, methods of connections, and specific anchors to be used.
- C. Submit prior to installation, bracing drawings for seismic protection of suspended ductwork and suspended electrical and communication cables, include:
1. Details illustrating all support and bracing components, methods of connection, and specific anchors to be used.
  2. Numerical value of applied gravity and seismic loads and seismic loads acting on support and bracing components.
  3. Maximum spacing of hangers and bracing.
  4. Seal of registered structural engineer responsible for design.
- D. Submit design calculations prepared and sealed by the registered structural engineer specified above in paragraph 1.3A.
- E. Submit for concrete anchors, the appropriate ICBC evaluation reports, OSHPD pre-approvals, or lab test reports verifying compliance with OSHPD Interpretation of Regulations 28-6.

#### **1.4 APPLICABLE PUBLICATIONS:**

- A. The Publications listed below (including amendments, addenda revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):  
355.2-07.....Qualification for Post-Installed Mechanical Anchors in Concrete and Commentary
- C. American Institute of Steel Construction (AISC):  
Load and Resistance Factor Design, Volume 1, Second Edition
- D. American Society for Testing and Materials (ASTM):  
A36/A36M-08.....Standard Specification for Carbon Structural Steel  
A53/A53M-10.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless  
A307-10.....Standard Specification for Carbon Steel Bolts and Stud; 60,000 PSI Tensile Strength.  
A325-10.....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

- A325M-09.....Standard Specification for High-Strength Bolts  
for Structural Steel Joints [Metric]
- A490-10.....Standard Specification for Heat-Treated Steel  
Structural Bolts, 150 ksi Minimum Tensile  
Strength
- A490M-10.....Standard Specification for High-Strength Steel  
Bolts, Classes 10.9 and 10.9.3, for Structural  
Steel Joints [Metric]
- A500/A500M-10.....Standard Specification for Cold-Formed Welded  
and Seamless Carbon Steel Structural Tubing in  
Rounds and Shapes
- A501-07.....Specification for Hot-Formed Welded and Seamless  
Carbon Steel Structural Tubing
- A615/A615M-09.....Standard Specification for Deformed and Plain  
Billet-Steel Bars for Concrete Reinforcement
- A992/A992M-06.....Standard Specification for Steel for Structural  
Shapes for Use in Building Framing
- A996/A996M-09.....Standard Specification for Rail-Steel and Axle-  
Steel Deformed Bars for Concrete  
Reinforcement
- E488-96(R2003).....Standard Test Method for Strength of Anchors in  
Concrete and Masonry Element
- E. American Society of Civil Engineers (ASCE 7) Latest Edition.
- F. International Building Code (IBC) Latest Edition
- G. VA Seismic Design Requirements, H-18-8, August 2013
- H. National Uniform Seismic Installation Guidelines (NUSIG)
- I. Sheet Metal and Air Conditioning Contractors National Association  
(SMACNA): Seismic Restraint Manual - Guidelines for Mechanical Systems,  
1998 Edition and Addendum

#### **1.5 REGULATORY REQUIREMENT:**

- A. IBC Latest Edition. Design for Site Class "D" and Occupancy Class "IV" with  $S_s$  assigned the value of 0.423 and  $F_a$  assigned the value of 1.45.
- B. Exceptions: The seismic restraint of the following items may be omitted:
1. Equipment weighing less than 400 pounds, which is supported directly on the floor or roof.
  2. Equipment weighing less than 20 pounds, which is suspended from the roof or floor or hung from a wall.
  3. All piping suspended by individual hangers, 12 inches or less in length from the top of pipe to the bottom of the support for the hanger.



4. All electrical conduits, less than 2 ½ inches inside diameter.

## **PART 2 - PRODUCTS**

### **2.1 STEEL:**

- A. Structural Steel: ASTM A36
- B. Structural Tubing: ASTM A500, Grade B.
- C. Structural Tubing: ASTM A501.
- D. Steel Pipe: ASTM A53/A53M, Grade B.
- E. Bolts & Nuts: ASTM A307

### **2.2 CAST-IN-PLACE CONCRETE:**

- A. Concrete: 28 day strength, f'c = 5000 psi
- B. Reinforcing Steel: ASTM A615/615M or ASTM A996/A996M deformed.

## **PART 3 - EXECUTION**

### **3.1 CONSTRUCTION, GENERAL:**

- A. Provide equipment supports and anchoring devices to withstand the seismic design forces, so that when seismic design forces are applied, the equipment cannot displace, overturn, or become inoperable.
- B. Provide anchorages in conformance with recommendations of the equipment manufacturer and as shown on approved shop drawings and calculations.
- C. Construct seismic restraints and anchorage to allow for thermal expansion.
- D. Testing Before Final Inspection:
  1. Test 10-percent of anchors in masonry and concrete per ASTM E488, and ACI 355.2 to determine that they meet the required load capacity. If any anchor fails to meet the required load, test the next 20 consecutive anchors, which are required to have zero failure, before resuming the 10-percent testing frequency.
  2. Before scheduling Final Inspection, submit a report on this testing indicating the number and location of testing, and what anchor-loads were obtained.

### **3.2 EQUIPMENT RESTRAINT AND BRACING:**

- A. Electrical components and conduits; and telecommunication wires and cable trays
- A. Support and brace conduits and cable trays; and telecommunication wires and cable trays to resist directional forces (lateral, longitudinal and vertical).
- B. Provide supports and anchoring so that, upon application of seismic forces, conduit and cable trays remains fully connected as operable systems which will not displace sufficiently to damage adjacent or connecting equipment, or building members.

**3.3 PARTITIONS**

- A. In buildings with flexible structural frames, anchor partitions to only structural element, such as a floor slab, and separate such partition by a physical gap from all other structural elements.

**3.4 CEILINGS AND LIGHTING FIXTURES**

- A. At regular intervals, laterally brace suspended ceilings against lateral and vertical movements, and provide with a physical separation at the walls.
- B. Independently support and laterally brace all lighting fixtures. Refer to applicable portion of lighting specification, Section 26 51 00, INTERIOR LIGHTING.

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**SECTION 14 12 11**  
**ELECTRIC DUMBWAITERS GEARED TRACTION AND WINDING DRUM**

**PART 1 - GENERAL**

1.1 SUMMARY AND DEFINITIONS

A. Related Documents

1. Section 01 33 23 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
2. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-rated construction.
3. SECTION 09 06 00, SCHEDULE FOR FINISHES: As a master format for construction projects, to identify interior and exterior material finishes for type, texture, patterns, color and placement.
4. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirements for seismic restraint of non-structural components.
5. Section 14 99 00, Elevator Maintenance Requirements
6. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.
7. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.
8. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
9. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.
10. Section 26 24 16, PANELBOARDS: Low voltage panelboards.
11. Section 26 51 00, INTERIOR LIGHTING: Fixture and ballast type for interior lighting

B. Intent

1. This section includes:
  - a. Two (2) traction cart lifts (Clean & Dirty)
  - b. One (1) dumbwaiter (pharmacy)
2. The following outlines the scope of work covered in this section:
  - a. Upgrading the door operating mechanism on the two (2) cart lifts with Courion's retrofit for the existing

- Magnagrip operating system, including any necessary wiring, cab modification, and control upgrades
- b. Routine maintenance of the doors on the pharmacy dumbwaiter including new gibs, tracks, relating hardware and interlocks to provide smooth reliable operation.
  3. Related equipment shall be designed, constructed, installed and adjusted to produce the highest results with respect to smooth, quiet, convenient and efficient operation, durability, economy of maintenance, and the highest standard of safety.
  4. It is not the intent of these specifications to detail the construction and design of all parts of the equipment, but it is expected that the type, materials, design, quality of work and construction of each part shall be adequate for the service required, durable, properly coordinated with all other parts, and in accordance with the best commercial standards applicable and of the highest commercial efficiency possible.
  5. Electric and magnetic circuits and related parts shall be of proper size, design and material to avoid heating and arcing, and all other objectionable effects which may reduce the efficiency of operation, economy of maintenance and/or net-useful life of the apparatus.
  6. Minimum requirements for design, materials, etc., are for certain parts of the equipment. Equivalent requirements approved by the Government shall apply to such parts as are of special design, construction or material and to which the specified requirements are not directly applicable. These minimum requirements as a whole shall be considered as establishing proportionate general minimum standards for all parts of the equipment.
  7. General requirements for design, materials and construction are intended primarily to apply to the heavy-duty and important parts of the equipment mentioned and to other parts of similar duty and importance. Less important and light-duty parts may be of the standard design, materials and construction provided that, in the opinion of the Government, such standards are in accordance with the best commercial practice and are fully adequate for the purpose of use. All such variations shall be made only on the Government's written approval.
  8. All equipment and component parts installed, supplied or provided under this contract shall be manufactured and distributed by a third-party, non-installer company servicing the vertical transportation industry.

- a. Apparatus shall conform to the design and construction standards referenced herein, and shall be rated the best commercial grade suitable for this application.
  - b. Equipment and component systems shall not employ any experimental devices or proprietary designs that could hamper and/or otherwise prohibit subsequent maintenance repairs or adjustments by all qualified contractors.
  - c. Manufacturers of the apparatus shall provide technical support and parts replacements for their equipment and component systems for a minimum of twenty (20) years, and issue such guarantee of support to the purchaser with written certification naming the final Owner of their product(s) to ensure the apparatus or systems remain maintainable regardless of who may be selected for future service.
9. All equipment provided shall be factory and field tested with a history of design reliability and net-useful life established.
- a. Contractor must be able to demonstrate the apparatus to be installed has been used successfully in a substantially similar manner under comparable conditions.
  - b. If the apparatus proposed differs substantially in construction, material composition, design, size, capacity, duty or other such rating from the equipment previously used for the same purpose by the manufacturer, the Government may reject the apparatus or require the vendor test and demonstrate the adequacy and suitability for this particular situation. Any necessary tests shall be performed at the sole expense of the Contractor with no prior guarantee of acceptance after the testing procedure.
10. The Contractor shall not use as part of the permanent equipment any experimental devices, proprietary design, components; construction of materials which have not been fully tried out in at least substantially similar or under comparable service, except as may be especially approved by the Government. If any important equipment or devices to be used on this installation differ substantially in construction, materials, design, size, capacity or duty from corresponding items previously used for the same purpose by the manufacturer, they shall pass such tests as the Government may require to fully show their adequacy and suitability. These tests shall be in addition to tests herein specified and shall be made at the expense of the Contractor.

11. Certain design limitations, tests, etc., are herein specified as a partial check of the adequacy of design, construction and materials used. These requirements do not cover all features necessary to ensure satisfactory and approved operation, etc., of the equipment.
12. It is understood, the entire system shall be designed, fabricated, modified and/or upgraded in full compliance with applicable local laws and code standards and government requirements. The absence of a particular item or requirement shall not relieve the Contractor of the full and sole responsibility for such equipment, features and/or procedures.
13. The Specifications are intended to include all engineering, material, labor, testing, and inspections needed to achieve work specified by the Contract Documents. Inasmuch as it is understood that any incidental work necessary to complete the project is also covered by the Specifications, bidders are cautioned to familiarize themselves with the existing job site conditions. Additional charges for material or labor shall not be permitted subsequent to execution of the Contract.
14. Bidders must report discrepancies or ambiguities occurring in the Specifications to the Government for resolution prior to the bidding deadline, otherwise the Specifications shall be deemed acceptable in their existing form.

C. Abbreviations and Symbols

1. The following abbreviations, Associations, Institutions, and Societies may appear in the Project Manual or Contract Documents:

AHJ	Authority Having Jurisdiction
AIA	American Institute of Owners
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
FAR	Federal Acquisition Regulations
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Agency
OSHA	Occupational Safety and Health Act
VAMC	Veterans Administration Medical Center
PDF	Portable Document Format
CAD	Computer Aided Design

D. Codes and Ordinances / Regulatory Agencies

1. Work specified by the Contract Documents shall be performed in compliance with applicable Federal ordinances in effect at the time of Contract execution. Elevator installation shall meet the requirements of the latest editions published and adopted by the United States Department of Veterans Affairs on the date contract is signed. Regulations of the Authority Having Jurisdiction shall be fulfilled by the Contractor and Subcontractors. The entire installation, when completed, shall conform with all applicable regulations set forth in the latest editions of:
  - a. Site Safety Manual (Construction and Maintenance Documents) including site safety manual acknowledgement and verification requirements.
  - b. Local and/or State laws applicable for logistical area of project work.
  - c. Building Code applicable to the AHJ.
  - d. Elevator Code applicable to the AHJ.
  - e. Safety Code for Dumbwaiters and Escalators, ASME A17.1 and all supplements as modified and adopted by the AHJ.
  - f. Safety Code for Dumbwaiters and Escalators, A17.1S supplement to A17.1 as modified and adopted by the AHJ for Machine Room Less installations (MRL).
  - g. Guide for Inspection of Dumbwaiters, Escalators, and Moving Walks, ASME A17.2.
  - h. Safety Code for Existing Dumbwaiters and Escalators, ASME A17.3 as modified and adopted by the AHJ.
  - i. Guide for emergency evacuation of passengers from Dumbwaiters, ASME A17.4.
  - j. National Electrical Code (ANSI/NFPA 70).
  - k. American With Disabilities Act - Accessibility Guidelines for Building and Facilities and/or A17.1 Accessibility as may be applicable to the AHJ.
  - l. ASME A17.5/CSA-B44.1 - Elevator and escalator electrical equipment.
  - m. VAMC Standards.
  - n. VA Barrier Free Design Guide PG\_18\_13
  - o. International Building Code (IBC)
  - p. National Fire Protection Association:
    - 1) NFPA 13-10: Standard for the installation of Sprinkler Systems
    - 2) NFPA 70-11: National Electrical Code
    - 3) NFPA 72-10: National Fire Alarm and Signaling Code
    - 4) NFPA 101-09: Life Safety Code
    - 5) NFPA 252-08: Fire Test of Door Assemblies

- q. American Society for Testing and Materials (ASTM):
  - 1) A1008/A1008M-10, Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength
  - 2) Low Alloy and High Strength Low-Alloy with Improved Farability
  - 3) E1042-02(R2008), Acoustically Absorptive Materials Applied by Trowel or Spray
- r. Society of Automotive Engineers, Inc. (SAE)
  - 1) J517-10, Hydraulic Hose, Standard
- s. Gauges:
  - 1) For Sheet and Plate: U.S. Standard (USS)
  - 2) For Wire: American Wire Gauge (AWG)
- t. American Welding Society (AWS):
  - 1) D1.1-10, Structured Welding Code Steel
- u. National Electrical Manufacturers Association (NEMA):
  - 1) LD-3-05, High Pressure Decorative Laminates
- v. Underwriter's Laboratories (UL):
  - 1) 486A-03, Safety Wire Connectors for Copper Conductors
  - 2) 797-07, Safety Electrical Metallic Tubing
- w. Institute of Electrical and Electronic Engineers (IEEE)
- x. Regulatory Standards: Uniform Federal Accessibility Standards
- y. Federal Specifications (Fed. Spec.):
  - 1) J-C-30B, Cable and Wire, Electrical (Power, Fixed Installation)
  - 2) J-C-580, Cord, Flexible, and Wire, Fixture
  - 3) W-S-610, Splice Connectors
  - 4) W-C-596F, Connector, Plug, Electrical; Connector, Receptacle, Electrical
  - 5) W-F-406E, Fittings for Cable, Power, Electrical and Conduit, Metal, Flexible
  - 6) HH-I-558C, Insulation, Blankets, Thermal (Mineral Fiber, Industrial Type)
  - 7) W-F-408E, Fittings for Conduit, Metal, Rigid (Thick Wall and Thin Wall [EMT] Type)



- 8) RR-W-410, Wire Rope and Strand
- 9) TT-E-489J, Enamel, Alkyd, Gloss, Low VOC Content
- 10) QQ-S-766, Steel, Stainless and Heat Resisting, Alloys, Plate, Sheet and Strip

2. The Contractor shall advise the Owner's Representative of pending code changes that could be applicable to this project and provide quotations for compliance with related costs.

#### E. Definitions

1. Defective Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Definitions in ASME A17.1 as amended or modified by the AHJ apply to work of this Section.

### 1.2 SUBMITTALS

#### A. Submittals

1. Submit in accordance with Specification Section 01 33 23, SHOP DRAWINGS for the Courion door upgrade, PRODUCT DATA, and SAMPLES.
2. Prior to beginning the work, the Contractor shall submit and have approved copies of layout drawings, shop drawings and standard cuts showing any modifications. These items shall include:
  - a. A plan view of the hoistway and machine room. Plans shall include a 1/4" = 1'-0" scaled drawing showing room layout including locations of the machine, governor, controller, resistor pack disconnect, utilization equipment, HVAC equipment, etc.
  - b. Plans need to show clearance dimensions and machine control room door swing direction. Plans shall include a 1/4" = 1'-0" scaled elevation drawing of elevator equipment
  - c. Include a 1/8" = 1'-0" architectural plan showing the location of the elevator machine control space and the hoist way. Plan shall show room names, location of space in the building, and corridors.

- d. Equipment clearances will need to comply with ASME 17.1, Section 2.7 s-2005 and 2011 National Electrical Code, Article 110 and Article 620.
  - e. Elevation and placement of equipment in the pit, including reaction of supports and buffer impact loads.
  - f. Top and bottom clearances of overtravel of car and counterweight assemblies.
  - g. All accessories.
3. The Government and the Owner's Representative shall pass on the submittals with reasonable promptness and the Contractor shall be responsible to ensure that there will be no delay in their work or that of any other trade involved.
  4. Approved filing and submittal requirements must be completed before equipment and related materials are ordered.
  5. Copies of Department of Buildings' permits and/or governing authority's documents will be posted at the job site with copies issued to the Owner's Agent, Owner's Representative and Government.
  6. Samples of wood, metal, plastic, paint or other architectural finish material applicable to this project shall be submitted for approval by the Owner's designee. Samples shall include the following:
    - a. One (1) each, of stainless steel, 75 mm x 125 mm (3 in. x 5 in.)
    - b. One (1) each, of baked enamel, 75 mm x 125 mm (3 in. x 5 in.)
    - c. One (1) each, of color vinyl floor tile
    - d. One (1) each, of protection pads, 75 mm x 125 mm (3 in. x 5 in.) if used
    - e. One (1) each, car and hoistway Braille plate sample
    - f. One (1) each, car and hall button sample
    - g. One (1) each, car and hall lantern/position indicator sample
    - h. One (1) each, wall and ceiling material finish sample
    - i. One (1) each, car lighting sample
    - j. No other samples of materials specified shall be submitted unless specifically requested after submission of manufacturer's name
  7. Each submittal will indicate the specification section, page, and standard that the product complies with.
  8. Name of manufacturer, type or style designation, and applicable data of the following equipment shall be shown on the elevator layouts:

- a. Hoisting Machine.
- b. Hoisting Machine Motor, HP and RPM ratings, Voltage, Starting and Full Load Ampere, and Number of Phases.
- c. Controller
- d. Starters and Overload Current Protection Devices.
- e. Car Safety Device; maximum and minimum rated loads and rated speeds.
- f. Governor
- g. Electric Door Operator; HP and RPM ratings, Voltage and Ampere rating of motor.
- h. Hoistway Door Interlocks.
- i. Car and Counterweight Buffers; maximum and minimum rated loads, maximum rated striking speed and stroke.
- j. Hoist and Compensation Ropes; ultimate breaking strength, allowable working load, and actual working load.
- k. Complete drawings of modifications of the elevator car enclosure, showing dimensioned details of construction, fastenings to platform, car lighting, ventilation, ceiling framing, top exits, and location of car equipment.
- l. Complete dimensioned detail of vibration isolating foundations for traction hoisting machines.
- m. Dimensioned drawings showing details of:
  - 1) All signal and operating fixtures.
  - 2) Car and counterweight roller guides.
  - 3) Hoistway door tracks, hangers, and sills.
  - 4) Door operator, infrared curtain units.
  - 5) Drawings showing details of controllers and supervisory panels.
  - 6) Cut sheets and drawings showing details of controllers and supervisory panels.
  - 7) Furnish certificates as required under: Paragraph "QUALIFICATIONS".

B. Measurements and Drawings

1. Drawings or measurements included with the bidding material shall be for the convenience of the bidders only and full responsibility for detailed dimensions lies with the Contractor.
2. In the execution of the work on the job, the Contractor shall verify all dimensions with the actual conditions.
3. Where the work of the Elevator Contractor is to join other trades, the shop drawings shall show the actual dimensions and the method of joining the work of the various trades.
4. The successful bidder will submit the stamped structural engineering data for approval to the Government and

ownership group, prior to any work being performed on any building structural material.

C. Changes in Scope of Work

1. The Owner may at any time make changes in the specifications, plans and drawings, omit work, and require additional work to be performed by the Contractor.
  - a. Each such addition or deletion to the Contract shall require the Owner and the Contractor to negotiate a mutually acceptable adjustment in the contract price, and, for the Contractor to issue a change order describing the nature of the change and the amount of price adjustment. All changes will be governed by the FAR.
  - b. The Contractor shall make no additions, changes, alterations or omissions or perform extra work except on written authorization of the Owner.
  - c. Each change order shall be executed by the Contractor, Owner, and the Government.

D. Keys

1. Upon the initial acceptance of work specified by the Contract Documents on each unit, the Contractor shall deliver to the Locksmith, six (6) keys for each general key-operated device that is provided under these specifications in accordance with ASME A17.1, Part 8 standards as may be adopted and modified by the AHJ.
2. All other keying of access or operation of equipment shall be provided in accordance with ASME A17.1 Part 8 as may be adopted and modified by the AHJ.
3. All key switches associated with the Fireman's Service features shall be keyed to the ASME A17.1-2010 requirements, including the use of FEOK1 keys in all applicable Firemen's Service key-switch assemblies.
4. Where key-operated switches are furnished in conjunction with any component of this elevator installation, the cylinders shall be keyed to use an IC core that is compatible with Corbin Russwin Large Format Interchangeable Core, 62A1, 6 - Pin Keyway.

E. Diagnostic Tools

1. Prior to seeking final acceptance of the project, the Contractor shall deliver to the Owner any specialized tools required to perform diagnostic evaluations, adjustments, and/or programming changes on any microprocessor-based

control equipment installed by the Contractor. All such tools shall become the property of the Owner.

- a. Owner's diagnostic tools shall be configured to perform all levels of diagnostics, systems adjustment and software program changes which are available to the Contractor.
  - b. Owner's diagnostic tools that require periodic re-calibration and/or re-initiation shall be performed by the Contractor at no additional cost to the Owner for a period equal to the term of the maintenance agreement from the date of final acceptance of the project.
  - c. The Contractor shall provide a temporary replacement, at no additional cost to the Owner, during those intervals in which the Owner might find it necessary to surrender a diagnostic tool for re-calibration, re-initiation or repair.
2. Contractor shall deliver to the Owner, printed instructions, access codes, passwords or other proprietary information necessary to interface with the microprocessor-control equipment.

F. Wiring Diagrams, Operating Manuals and Maintenance Data

1. Comply with the requirements of Division 01.
2. The manuals shall also be submitted in electronic format on non-volatile DVD media, incorporating raw 'CAD' and Acrobat 'PDF' file formats.
3. Manuals, as well as electronic copies, shall contain the following:
  - a. Step-by-step adjusting, programming and troubleshooting procedures that pertain to the solid-state microprocessor-control and motor drive equipment.
  - b. Passwords or identification codes required to gain access to each software program in order to perform diagnostics or program changes.
  - c. A composite listing of the individual settings chosen for variable software parameters stored in the software programs of both the motion and dispatch controllers.
  - d. Method of control and operation including detailed description of the system logic.
4. Provide four (4) sets three (3) hard copies and one digital of "AS INSTALLED" straight-line wiring diagrams in both hard and electronic format in accordance with the following requirements:

- a. Displaying name and symbol of each relay, switch or other electrical component utilized including identification of each wiring terminal.
  - b. Electrical circuits depicted shall include all those which are hard wired in both the machine room and hoistway.
  - c. Supplemental wiring changes performed in the field shall be incorporated into the diagrams in order to accurately replicate the completed installation.
5. Furnish four (4) three (3) bound and one digital set of instructions and recommendations for maintenance, with special reference to lubrication and lubricants. All manuals shall also be submitted in electronic format on non-volatile DVD media, incorporating raw 'CAD' and Acrobat 'PDF' file formats.
  6. Changes made during the warranty period shall be noted on the drawings in adequate time to have the finalized drawings reproduced for mounting in the machine room no later than six months prior to the expiration of the warranty period.

G. Instruction of VA Personnel

1. Provide competent instruction to VA personnel regarding the operation of equipment and accessories installed under this contract, for a period equal to one eight hour day. Instruction shall commence after completion of all work and at the time and place directed by the Resident Engineer.
2. Written instructions in triplicate relative to care, adjustments and operation of all equipment and accessories shall be furnished and delivered to the Resident Engineer in independently bound folders. DVD recordings will also be acceptable. Written instructions shall include correct and legible wiring diagrams, nomenclature sheet of all electrical apparatus including location of each device, complete and comprehensive sequence of operation, complete replacement parts list of with descriptive literature, and identification and diagrams of equipment and parts. Information shall also include electrical operation characteristics of all circuits, relays, timers, electronic devices, and related characteristics for all rotating equipment.
3. Provide supplementary instruction for any new equipment that may become necessary because of changes, modifications or replacement of equipment or operation under requirements of paragraph entitled "Warranty of Construction".

### 1.3 QUALITY ASSURANCE

#### A. Materials and Quality of Work

1. All materials are to be new and of the best quality of the kind specified.
2. Installation of such materials shall be accomplished in a neat manner and be of the highest quality.
  - a. Should the Contractor receive written notification from the Owner stating the presence of inferior, improper, or unsound materials or quality of installation, the Contractor shall, within twenty-four (24) hours, remove such work or materials and make good all other work or materials damaged.
  - b. Should the Owner permit said work or materials to remain, the Owner shall be allowed the difference in value or shall, at its election, have the right to have said work or materials repaired or replaced as well as the damage caused thereby, at the expense of the Contractor, at any time within one (1) year after the completion of the work; and neither payments made to the Contractor, nor any other acts of the Owner shall be construed as evidence of acceptance and waiver.

#### B. Mechanical Design Requirements (General)

1. The following typical requirements shall apply to all parts of the work where applicable and are supplementary to other requirements noted under the respective headings.
  - a. All bearings, pivots, guides, guide shoes, gearing, door hanger sheaves, door hanger tracks and similar elements subject to friction or rolling wear in the entire elevator installation shall be accurately and smoothly finished and shall be arranged and equipped for adequate and convenient lubrication. Means shall be provided for flushing and draining the larger bearings and gear case. All oiling holes shall have dustproof, self-cleaning caps.
  - b. Bearings of governor and governor sheaves and important supporting bearings of other parts in motion when the elevator is traveling shall, unless otherwise specified or approved, be of ball or roller bearing type.
  - c. Bearings for brake levers and similar uses where the amount of movement under load is light and the wear negligible may be unlined.
  - d. All plain bearings shall be liberally sized in accordance with the best commercial elevator usages

which have proved entirely satisfactory on heavy-duty installations.

- e. Bearings of motors shall be arranged and equipped for adequate automatic lubrication. Ring or chain oilers, spring-fed grease cups and equivalent devices properly used in accordance with the best commercial elevator practice will be acceptable. Approved means shall be provided for visibly checking the amount of lubricant contained and for flushing and draining. Means shall also be provided for preventing leakage of lubricant when the reservoirs or grease cups are filled to proper levels.
- f. Ball and roller bearings shall be of liberal size and of a type and make which have been extensively and successfully used on other similar, heavy-duty elevator installations. They shall be fully enclosed. Loading, lubrication, support and all other conditions of use shall be in accordance with the recommendations of the bearing manufacturer based on previous extensive and satisfactory elevator usage.
- g. All armature spiders and similar items intended to rotate with their shafts shall be keyed and/or firm press or shrunk fit on the shafts. Set screw fastening will be permitted only for minor items not subject to hoisting loads and where means for field adjustment is required.
- h. All bolts used to connect moving parts, bolts carrying hoisting stresses and all other bolts, except guide rail bolts, subject to vibration or shock shall be fitted with adequate means to prevent loosening of the nuts and bolts. Bolts transmitting important shearing stresses between machine parts shall have tight body fit in drilling holes.
- i. All machine work, assembling and installing shall be done by skilled and experienced mechanics using first-class, modern equipment and tools. All work shall be thoroughly high grade in every respect. All parts will be manufactured to high precision standards so that wearing parts will be readily interchangeable with stock repair parts with a minimum of field fitting.
- j. All bearing and sliding surfaces of shafts, pins, bearings, bushings, guides, etc., shall be smoothly and accurately finished. They shall be assembled and installed in accurate alignment and with working clearance most suitable for the load, speed, lubrication and other conditions of use.
- k. Structural steel used for supporting and securing equipment and for the construction of car slings, etc., shall conform to the A.S.T.M. specification for



Structural Steel for Buildings. Design stresses shall not exceed those specified in the local Building Code.

1. Castings of motor frames, sheaves, gear casings, etc., shall be of the best quality metallurgically controlled, hard, close grained gray machinery cast iron, free from blow holes, sand holes, or shrinkage cracks, ground to remove overruns, sanded and machined so as to leave a finish suitable for its particular application. Surfaces of sheaves and brake drums shall be entirely free from defects and shall show a hardness of not less than 220 Brinell.

C. Electrical Design Requirements (General)

1. The following typical requirements shall apply to all parts of the work and are supplementary to other requirements noted under the respective headings.
  - a. The design and construction of the motors shall conform to the requirements of these specifications and to the ASME Standards for Rotating Electrical Machinery with revisions issued to the first day when the work of this Contract was advertised.
    - 1) Motors shall operate successfully under all loads and speeds and during acceleration and deceleration.
    - 2) Motors shall be designed for quiet operation without excessive heat.
    - 3) Insulation on motor coils and windings and on all insulated switch, relay, brake and other coils shall conform to the requirements for Class "H" insulation, as defined in ASME Standards for Rotating Electrical Machinery. All motors shall be impregnated twice.
    - 4) Switches, relays, etc., on controller, starter and signal panels and similar items on other parts of the equipment shall be the latest improved type for the condition of use. They shall function properly in full accordance with the requirements of the machines controlled and with the specified operating requirements of the elevator. Any of these parts showing wear or other injurious effects during the guarantee period to the extent that abnormal maintenance is required or indicated shall be replaced with proper and adequate parts by the Contractor.
    - 5) Contacts in elevator motor circuits which are intended to be opened by governors or other safety

devices shall be copper to carbon or other approved non-fusing type.

- 6) Where required, controllers and other component parts of the installation shall be labeled in accordance with the latest codes and standards as adopted and/or otherwise modified by the AHJ.
- 7) Electrical equipment, motors, controllers, etc., installed under this contract shall have necessary CSA/US or UL/US listing. Equipment shall be labeled or tagged accordingly.

#### D. Materials, Painting and Finishes

1. Two (2) coats of rust inhibiting machinery enamel shall be applied to exposed ferrous metal surfaces in the pit that do not have a galvanized, anodized, baked enamel, or special architectural finishes. All retained pit equipment that contains surface rust will be wire wheel brushed, cleaned, and primed with a rust inhibiting primer, prior to coating with two (2) coats of rust-inhibiting machinery enamel.
2. Two (2) coats of rust-inhibiting enamel paint to the machinery located within the machine room and secondary level (where applicable) as well as to the machine room and pit floors.
3. Architectural metal surfaces of bronze or similar non-ferrous materials which are specified to be refinished, re-clad and/or provided new, shall be sufficiently clear coated so as to resist tarnishing during normal usage for a period of not less than twelve (12) months after final acceptance by the Owner.
4. Identify all equipment including buffers, crosshead, safety plank, machine, controller, drive, governor, disconnect switch, etc., by 4" high numerals which shall contrast with the background to which it is applied. The identification shall be either decalcomania or stencil type.
5. Paint or provide decal-type floor designation not less than four (4) inches high on hoistway doors (hoistway side), fascias and/or walls as required by Code at intervals not exceeding 7'-0". The color of paint used shall contrast with the color of the surface to which it is applied.
6. Upon completion of installation and prior to final inspection, all equipment shall be thoroughly cleaned of grease, oil, cement, plaster and other debris. All equipment, except that otherwise specified as to architectural finish, shall then be given two coats of paint of approved color, conforming to manufacturer's standard. Two (2) coats of rust-inhibiting machinery enamel shall be applied to all surfaces of the bottom of

the car platform, including bolster channels, stringers, and related hardware.

7. Fascia plates, top and bottom shear guards, dust covers, hanger covers, and other metalwork, including built in or hidden work and structural metal, (except stainless steel entrance frames and surfaces to receive baked enamel finish) shall be given one approved prime coat in the shop, and one field coat of paint of approved color.
8. If painting of the equipment becomes disruptive to the staff/patients, arrangements shall be made for the painting to occur after hours which are approved by the Owner. Any overtime fees to do the painting shall be included in the base bid amount.

E. General

1. Cold-rolled Sheet Steel Sections: ASTM A1008, commercial steel, Type "B".
  - a. Shop Prime: Factory-applied baked on coat of mineral filler and primer.
  - b. Finish Paint: Two (2) coats of low sheen baked enamel, color as selected by the Owner.
  - c. Steel Equipment: Two (2) coats of manufacturer's standard rust-inhibiting paint.
2. Steel Supports and Reinforcement: ASTM A36
3. Stainless Steel Bars and Shapes: ASTM A276
4. Stainless Steel Tubes: ASTM A269
5. Aluminum Extrusions: ASTM B221
6. Structural Tubing: ASTM A500
7. Bolts, Nuts and Washers: ASTM A325 and A490.
8. Clear Tempered Glass: ASTM C1048

F. Handicapped Requirements (ADAAG)

1. Locate the alarm button and emergency stop switch at 35", and floor and control buttons not more than 48" above the finished floor. The alarm button shall illuminate when pressed for visual acknowledgement to user.
2. Provide raised markings in the panel to the left of the car call and other control buttons. Letters and numbers shall be a minimum of 5/8" and raised .03" and shall be in contrasting color to the call buttons and cover plate.
3. The centerline of new hall push button shall be 42" above the finished floor.
4. The hall arrival lanterns or cab direction lantern provided shall sound once for the "up" direction and twice for the "down" direction. Design and locate fixtures per Federal standards.

5. Provide floor designations at each entrance on both sides of jamb at a height of 60" above the floor. Designations shall be 2" high, raised .03" on a contrasting color background as selected by the Owner. Any existing Braille plates will be removed and the entrance refinished to like new conditions.
  - a. Use cast metal plates and polished numbers mechanically secured with tamper-proof hardware.
  - b. Designations shall be 2" high, raised .03" on a contrasting color background as selected by the Owner. Surface mounted plates are not acceptable.
6. Ensure sill-to-sill running clearances do not exceed 1-1/4" at all landings served.

G. Qualifications

1. Approval by the Contracting Officer is required for products and services of proposed manufacturers, suppliers and installers and shall be contingent upon submission of certificates by the Contractor stating the following:
  - a. Elevator contractor is currently and regularly engaged in the installation of elevator equipment as one of his principal products.
  - b. Elevator contractor shall have three years of successful experience, trained supervisory personnel, and facilities to install elevator equipment specified herein.
  - c. Elevator Mechanic (Installer) shall have passed a Mechanic Examination approved by the U.S. Department of Labor and have technical qualifications of at least five years of experience in the elevator industry or 10,000 hours of field experience working in the elevator industry with technical update training. Apprentices shall be actively pursuing Certified Elevator Mechanic status. Certification shall be submitted for all workers employed in this capacity.
2. Approval of Elevator Contractor's equipment will be contingent upon their identifying an elevator maintenance service provider that shall render services meeting the requirements of Section 14.99.00 Elevator Maintenance Requirements included with this document, notification, together with certification that the quantity and quality of replacement parts stock is sufficient to warranty continued operation of the elevator installation.
3. Approval will not be given to elevator contractors and manufacturers who have established on prior projects,

either government, municipal, or commercial, a record for unsatisfactory elevator installations, have failed to complete awarded contracts within the contract period, and do not have the requisite record of satisfactorily performing elevator installations of similar type and magnitude.

4. Equipment within a group of electric traction elevators shall be the product of the same manufacturer.
5. The Contractor shall provide and install safety devices that have been subjected to tests witnessed and certified by an independent professional testing laboratory that is not a subsidiary of the firm that manufactures supplies or installs the equipment.
6. Welding at the project site shall be made by welders and welding operators who have previously qualified by test as prescribed in American Welding Society Publications AWS D1.1 to perform the type of work required. Certificates shall be submitted for all workers employed in this capacity. A welding or hot work permit is required for each day and shall be obtained from the VAMC safety department. Request permit one day in advance.
7. Electrical work shall be performed by a Licensed Master Electrician and Licensed Journeymen Electricians as requirements by NEC. Certificates shall be submitted for all workers employed in this capacity.

#### 1.4 DELIVERY / STORAGE / HANDLING / COORDINATION

##### A. Delivery and Storage of Material and Tools

1. Comply with the requirements of Division 01.
2. Delivery, Storage and Handling:
  - a. Deliver materials to the site ready for use in the accepted manufacturer's original and unopened containers and packaging, bearing labels as to type of material, brand name and manufacturer's name. Delivered materials shall be identical to accepted samples.
  - b. Store materials under cover in a dry and clean location, off the ground.
  - c. Remove delivered materials which are damaged or otherwise not suitable for installation from the job site and replace with acceptable materials.
3. The Owner shall bear no responsibility for the materials, equipment or tools of the Contractor and shall not be liable for any loss thereof or damage thereto.

4. The Contractor shall confine storage of materials on the job site to the limits and locations designated by the Owner and shall not unnecessarily encumber the premises or overload any portion with materials to a greater extent than the structural design load of the Facility.
5. The transportation of material from the storage site to the project will be the responsibility of the elevator contractor.
6. Any requirements for on or offsite storage will be the responsibility of the elevator contractor. Onsite storage costs required for storage containers will be the responsibility of the elevator contractor.

B. Work With Other Trades / Coordination

1. Coordinate installation of sleeves, block outs, equipment with integral anchors, and other items that are embedded in concrete or masonry for the applicable equipment. Furnish templates, sleeves, equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
2. Coordinate sequence of installation with other work to avoid delaying the Work.
3. Coordinate locations and dimensions of other work relating to Dumbwaiters including pit ladders, access for hoistway venting including heat and fire smoke sensor placement, sumps in pits; entrance sub sills; beam pocket placement verification, machine beams; and electrical service, electrical outlets, lights, and switches in pits and machine rooms, overhead sheave rooms and hoistways.
4. Coordinate running of the car top access for all contractors for related hoistway work during regular and overtime hours. Costs for running the elevator for contractors will be part of the base bid pricing.
5. Coordinate sequence of installation for group features including dispatching, emergency power, Firemen's service operation, testing, and inspections with the ownership group and or owner's representative.

C. Removal of Rubbish and Existing Equipment

1. On a scheduled basis, the Contractor shall remove from the job site all rubbish generated in performing work specified in the Contract Documents.
2. Any component of the existing elevator plant that is not reused under the scope of work specified in the Contract Documents shall become property of the Contractor and, as such, shall be removed from the premises at the Contractor's sole expense.

3. The Contractor agrees to dispose of the aforementioned equipment and rubbish in accordance with any and all applicable Federal, State, ICRA, and municipal environmental regulations, and further accepts all liability that may result from handling and/or disposing of said material.

D. Protection of Work and Property

1. The Contractor shall continuously maintain adequate protection of all their work from damage and shall protect the Owner's property from injury or loss arising out of this contract.
2. The Contractor shall make good any such damages, injury or loss, except such as may be directly caused by agents or employees of the Owner.
3. The Contractor shall provide full height, lockable barricades required to protect open hoistways or shafts per OSHA regulations. Such protection shall include any necessary guards or other barricades for employee protections during and after the modernization procedure.
4. See General requirement, Section 01 00 00.

1.5 RELATED WORK

A. Related Work by the Elevator Contractor included in the Base Bid

1. The following requirements shall be applicable based on prevailing conditions at the site of work and/or mandated modifications for code compliance.
  - a. Submission of Site Safety Manual for Construction and Maintenance Documents, including site safety manual acknowledgement and verification requirements.
  - b. Interface building fire smoke signal, wiring, controls, and telephone in machine room junction box.
  - c. Coordinate all related work by sub-contractors, including car top time for other trades to inspect and complete required work in the hoistway, machine room, and pits.
  - d. All elevator access car top time needed for other contractors to complete related work in the elevator shafts, secondary levels, and pits will be included in the base bid pricing. This time includes as needed elevator personnel to run the elevator for other contractors to access the elevator shafts, secondary levels, and pits as needed.
  - e. Interfacing materials and required integration time between the elevator contractor and the card reader

contractor for full installation capabilities a card reader system for all Dumbwaiters. The card reader is to be provided by the contractor and interfaced with the existing VA system.

- f. Provide any necessary cutting or patching for the installation of the new machines.
- g. The elevator contractor is responsible for all rigging, hoisting, crane work, and crane permits, as required, to remove existing equipment from the building and install new equipment. All crane picks / lifts will require a minimum of one-week notice in advance.
- h. Where the pit extends more than 3 feet below the sill of the pit access door, provide a permanent fixed metal ladder.
  - 1) Ladder shall extend no less than 48" above the sill of the access door. Handgrips shall extend from the ladder to a point no less than 48" above the sill of the access door where the ladder does not comply.
  - 2) The rungs shall be a minimum of 12" wide. Where prevailing conditions prevent a 12" wide rung, the rung may be reduced to no less than 9".
  - 3) The rungs shall be spaced 12" on center.
  - 4) A clear distance of no less than 4-½" from the centerline of the rungs and handgrips to the nearest permanent object in back of the ladder shall be provided.
- i. Provide the following signage, plates and tags:
  - 1) Provide access doors to each machinery space with signs that read "ELEVATOR MACHINE ROOM". Letters shall be not less than 2" high. All signage will require prior approval before installed.
  - 2) Provide all required manufacturer data plates and installation-specific tags and signs of the types and styles containing information as required by applicable Codes and Standards as adopted and/or modified by the AHJ.
  - 3) Signage to and on the machine room doors as required by applicable codes.
  - 4) Provide elevator identification numbers at or near the door frames of each elevator in the main fire recall lobbies. Size of numbering and style shall be contingent upon local code requirements or owner's standards.
- j. Provide hoist rope guards at the car and counterweight



drop side of the hoisting machine sheave and secondary sheaves to prevent accidental contact with the hoisting ropes. The guard shall extend from the point where the hoisting ropes penetrate the secondary floor to a point beyond where the ropes contact the traction and deflector sheaves. The guards shall be constructed so as to conceal pinch-points between ropes and sheave grooves.

- k. All costs associated with acceptance testing, including all overtime, inspector's fees and re-inspection costs shall be included in the base bid.
- l. If extenuating circumstances (i.e., separating cars, testing, inspection, etc.) require that multiple cars be removed from service simultaneously, the work shall be performed outside of the normal business hours at an agreed-upon time. A minimum of five (5) days advance written notice shall be given to the Owner and Elevator Consultant detailing the reason for needing to remove multiple Dumbwaiters from service simultaneously along with the estimated down time. The request shall be subject to review and approval by the Owner and Elevator Consultant and all work and associated expenses shall be included as part of the base bid pricing.
- m. Provide the resources and time required to coordinate work and scheduling requirements between all trades to perform the related work required as part of the elevator modernization project.
- n. Provide all necessary work to provide for a complete, legal, code compliant installation.
- o. Subsequent to contract execution, the Contractor shall perform the following procedures and engineering tasks relative to balance loading of system and cab work included under base specification requirements and alternative/optional upgrades:
  - 1) Perform balance load testing to determine existing conditions and requirements applicable to new/modified equipment.
  - 2) Provide data for Purchaser and/or their agents to evaluate any limitations that may be placed on design/finish options due to prevailing conditions or total suspended loading (weigh all cars).
  - 3) All costs to perform the above mentioned balance loading work is to be included in the base bid amount.
- p. Provide code compliant access requirements to get the elevator equipment into the machine rooms, pits, and

- hoistways. Any modifications to the building will require prior approval with ownership.
- q. Reuse and modify the existing power supplies to utilize the building power for the new controllers. Provide grounding wire for the system, including all disconnects feeders, and transformers, in accordance with NEC. Install locking provisions for circuit breakers as per code. If existing disconnects are not capable of being locked in the open (OFF) position, new mainline and/or auxiliary disconnect switches shall be provided. Any relocation of mainline disconnect switches (new or existing) shall be included.
  - r. Provide auxiliary power feeds with required distribution load center (circuit breaker panel) for intercommunication, CCTV systems, and cab lighting or other specialty devices existing or to be provided by the Elevator Contractor.
    - 1) Voltage shall be 110 VAC with one 15, Amp circuit breaker or fuse for lighting of each individual elevator car enclosure.
    - 2) Circuit breakers and/or fused disconnects shall be lockable in the "OFF" position in accordance with applicable code.
  - s. All lighting fixtures and related switches in the elevator machine room, hoistway, secondary levels, and pits will utilize LED fixtures and lighting.
  - t. Installation of new permanent LED lighting fixtures with protective guards and 110-volt duplex GFI receptacles inside the machine rooms and secondary levels. The illumination shall be no less than 30 foot-candles at floor level. A light control switch shall be provided immediately adjacent to the machine room entrance door. Provide necessary receptacles as required by Elevator Contractor to supply power to auxiliary elevator equipment and/or remotely located monitors.
  - u. The top surface of any setback or projection in the hoistway that measures 2" or more in width shall be beveled at an angle of not less than 75 degrees from horizontal, constructed from prime painted 14 gauge cold-rolled steel and installed so as to conform with ASME A17.1 elevator safety code as modified by, and/or in addition to codes and standards accepted by the AHJ.
  - v. Provide each elevator pit with a 110 volt GFI duplex receptacle and a permanent LED lighting fixture equipped with protective guard. Illumination shall be no less than 10 foot-candles at pit floor level. A

light control switch shall be provided and so positioned as to be readily accessible from the pit entrance door and/or ladder from the main lobby. The contractor will provide submittals for the design and layout of the fixtures. The fixture locations will be coordinated with the elevator contractor to ensure it does not hinder the operation of the elevator.

- w. Provide each machine room and pit with new self-closing, self-locking access door(s) where applicable. Locking means shall be spring-type arranged to permit the doors to be opened from the inside without a key.
- x. Provide new as needed fire emergency control interface provisions for automatic recall of the elevator(s) through operation of the fire detection system. Provisions shall be made for alternate designated fire recall landing with connection contingent on Codes recognized by the local governing authority. The interfacing contacts shall be wired to an electrical junction box located inside each elevator machine room for connection to the elevator control systems. Each wire shall be clearly labeled with its control function. Coordinate the type of interface required for the specific elevator control apparatus.
- y. All smoke ventilation provisions, including duct work, dampers, fans, fire control interfaces, hoistway vents, and key switches in accordance with local codes, shall be reviewed for proper operation and restored, or new provisions provided as required. Any other existing vents of unknown purpose shall be modified/deleted as per the AHJ and/or VA requirements.
- z. Installation of full sprinkler system as required per code, Federal requirements, and VA Standard guidelines for Healthcare facilities. Where sprinkler fire protective systems are provided inside any elevator hoistway, machine room, pit area, or associated machinery space, provisions shall be made for the disconnecting of the main line power supply from the affected elevator prior to activation. This means of disconnect shall be manually reset in accordance with code. Modifications to the existing sprinkler systems to comply with the requirements of the pit, hoistway, and machine room will be included as part of the specifications, including demolition of existing piping in the elevator pits.
- aa. Installation of emergency power control interface provisions to signal the elevator control apparatus of a transfer from normal (utility) power to the building emergency (generator) power supply. Also, provide additional control interface to give advanced

notification to the elevator control apparatus that the power source will transfer from emergency (generator) power to normal (utility) power. Interfacing contacts shall be wired to an electrical junction box located inside each machine room for connection to the elevator control equipment by the Elevator Contractor. Coordinate the type of interface required for the specific elevator control apparatus with the Elevator Contractor.

- 1) Normal Power/Emergency Power Control Signals consisting of two (2) dry contacts provided by other trades as part of this contract to function as follows:
  - a) One (1) dry contact normally open to make when Normal Power is available. (Logic state of dry contact is to be confirmed by the Manufacturer of the Elevator Control Equipment).
  - b) One (1) dry contact normally open to make when emergency power is available. (Logic state of dry contact is to be confirmed by the Manufacturer of the Elevator Control Equipment).
- bb. Modification to existing or installation of new HVAC provisions so as to maintain ambient temperature and humidity levels that are within the range specified by the microprocessor-control equipment manufacturers. Relocate any HVAC and condensation lines currently passing over controllers and power supplies in the machine room.
- cc. Provide a class "ABC" fire extinguisher in electrical machinery and control spaces. Locate the extinguisher in close proximity to the access door.
- dd. Provide necessary patching, repairing and installation of masonry and/or drywall for smooth and legal elevator hoistways.
- ee. Provide required guarding for pipes, conveying gases, vapors, and liquids in machine room, including panning and barriers for overhead applications as allowed by the AHJ.
- ff. Install a new disconnecting means for control systems the machine room that is not within direct sight of the mainline disconnects.
- gg. Review the existing smoke detector system and provide necessary equipment to comply with the requirements of A17.1, VA Guidelines, and/or the Local Governing

Authority. Provide all interface work required. Install all smoke detectors or heat detectors, shunt trip devices and interfaces related to the elevator system, as necessary. All interface work for the installation of the fire panel will need to be coordinated between the elevator contractor and the building facilities, including subcontractors providing the fire alarm panel. Install all smoke detectors or heat detectors, shunt trip devices and interfaces related to the elevator system as necessary.

- hh. Provide necessary receptacles as required by Elevator Contractor to supply power to auxiliary elevator equipment, pit sumps, remotely located monitors, and lobby panels.
- ii. Sumps in pits and machine rooms, where provided, shall be covered. The cover shall be level with the pit floor so as not to produce a tripping hazard.

## 1.6 WARRANTY / MAINTENANCE SERVICES

### A. Contract Close-Out, Guarantee and Warranties

- 1. Submit all labor and materials furnished in connection with elevator system and installation to terms of "Warranty of Construction" articles of FAR clause 52.246-21. The one year Warranty shall commence after final inspection, completion of performance test, and upon full acceptance of the installation and run concurrent with the guarantee period of service.
- 2. During warranty period if a device is not functioning properly in accordance with specification requirements, more maintenance than the contract requires keeping device operational, device shall be removed and a new device meeting all requirements shall be installed as part of work until satisfactory operation of installation is obtained. Period of warranty shall start anew for such parts from date of completion of each new installation performed, in accordance with foregoing requirements.

### B. Maintenance Coverage

- 1. The following maintenance coverage apply:
  - a. Interim Maintenance
    - 1) Provide full protective maintenance services and equipment coverage beginning with the contract award, during the work implementation procedure, and until final acceptance of the finished project.

- 2) Interim full comprehensive maintenance services shall be provided in accordance with Section 14.99.00 Elevator Maintenance Requirements, issued with these documents.
- 3) Costs related to interim maintenance shall be included in the base bid quotation.

b. Guaranty Period Services (GPS)

- 1) Furnish complete maintenance and inspection service on entire elevator systems. The modernized elevator systems shall be guaranteed for a period of one year beginning with the completion and acceptance of the last elevator installation by COR. Maintenance work shall be performed by Certified Elevator Mechanics and Apprentices supervised by the company that is providing the guaranteed period of service on the elevator equipment specified herein.
- 2) The warranty period for each elevator being modernized will start on a per-car basis, as each elevator is handed over with final acceptance to the Government.
- 3) The guarantee period will include full maintenance services in compliance with Section 14.99.00 Elevator Maintenance Requirements.

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION - DUMBWAITERS

A. Cart Lift #5(Clean)

1. Quantity	One (1)/ Retain
2. Type	Cart Lifts / Retain
3. Capacity (lbs.)	1000 / Retain
4. Speed (fpm)	200 / Retain
5. Travel in Feet	Field Verify
6. Roping / Ropes	
a. Hoisting	Retain Existing
b. Governor	Retain Existing - As applicable
c. Compensating	N/A
7. Number of Landings	Two (2) @ B and 4
8. Number of Openings	Two (2) @ B and 4
9. Front Openings	Two (2) @ B and 4
10. Rear Openings	N/A

11.	Operation	Retain
12.	Control	Retain
13.	Fireman's Service	Retain
14.	Machine Room, Secondary, Pit Lighting and GFI.	Provide new / As Required other trades as part of this contract
15.	Machine Type	Retain Existing
16.	Power Drive	Retain Existing
17.	Machine Location	Retain Existing
18.	Governor	Retain Existing / As applicable
19.	Car Platform / Sling / Safety	Retain Existing/Modify as required
20.	Counterweight	Retain Existing
21.	Counterweight Safety	Retain Existing
22.	Guide Rails	Retain Existing
23.	Guides	Retain Existing
24.	Buffers	Retain Existing
25.	Car Door Size / Type	27" x 4'-2" /New
26.	Hoistway Door Size / Type	Retain Existing
27.	Master Door Operator	Retrofit with Courion Magna Grip door package.
28.	Entrance Sills	Retain
29.	Tracks / Hangers / Interlocks / Closers	New
30.	Power Supply	Retain / Modify as required
31.	Wiring and Traveling Cables	Retain / Modify as required
32.	Number of Push Button Risers	One (1) Retain
33.	Hall Operating Fixtures	Retain Existing
34.	Car Operating Fixtures	Retain Existing
35.	Door Protective Device	New with retrofit
36.	Car Enclosure	Retain / Modify as required for retrofit
37.	Car Doors and tracks	New

B. Cart Lift #6 (Dirty)

1.	Quantity	One (1)/ Retain
2.	Type	Cart Lifts / Retain
3.	Capacity (lbs.)	1000 / Retain
4.	Speed (fpm)	200 / Retain
5.	Travel in Feet	Field Verify
6.	Roping / Ropes	
	d. Hoisting	Retain Existing
	e. Governor	Retain Existing - As applicable

	f. Compensating	N/A
7.	Number of Landings	Two (2) @ B and 4
8.	Number of Openings	Two (2) @ B and 4
9.	Front Openings	Two (2) @ B and 4
10.	Rear Openings	N/A
11.	Operation	Retain
12.	Control	Retain
13.	Fireman's Service	Retain
14.	Machine Room, Secondary, Pit Lighting and GFI.	Provide new / As Required Other trades as part of this contract
15.	Machine Type	Retain Existing
16.	Power Drive	Retain Existing
17.	Machine Location	Retain Existing
18.	Governor	Retain Existing / As applicable
19.	Car Platform / Sling / Safety	Retain Existing/Modify as required
20.	Counterweight	Retain Existing
21.	Counterweight Safety	Retain Existing
22.	Guide Rails	Retain Existing
23.	Guides	Retain Existing
24.	Buffers	Retain Existing
25.	Car Door Size / Type	27" x 4'-2" /New
26.	Hoistway Door Size / Type	Retain Existing
27.	Master Door Operator	Retrofit with Courion Magna Grip door package.
28.	Entrance Sills	Retain
29.	Tracks / Hangers / Interlocks / Closers	New
30.	Power Supply	Retain / Modify as required
31.	Wiring and Traveling Cables	Retain / Modify as required
32.	Number of Push Button Risers	One (1) Retain
33.	Hall Operating Fixtures	Retain Existing
34.	Car Operating Fixtures	Retain Existing
35.	Door Protective Device	New with retrofit
36.	Car Enclosure	Retain / Modify as required for retrofit
37.	Car Doors and tracks	New

C. Dumbwaiter (Pharmacy)

1.	Quantity	One (1) / Retain
2.	Type	Dumbwaiter / Retain
3.	Capacity (lbs.)	500 lbs. / Retain



4.	Speed (fpm)	50 / Retain
5.	Travel in Feet	Field Verify
6.	Roping / Ropes Hoisting	Retain Existing
7.	Number of Landings	Two (2) @ B and 4
8.	Number of Openings	Two (2) @ B and 4
9.	Front Openings	Two (2) @ B and 4
10.	Rear Openings	N/A
11.	Operation	Call and Send
12.	Control	Retain
13.	Fireman's Service	Retain
14.	Machine Room, Secondary, Pit Lighting and GFI.	Provide new / As Required other trades as part of this contract
15.	Machine Type	Retain Existing
16.	Power Drive	Retain Existing
17.	Machine Location	Retain Existing
18.	Governor	Retain Existing / As applicable
19.	Car Platform / Sling / Safety	Retain Existing
20.	Counterweight	N/A
21.	Counterweight Safety	N/A
22.	Guide Rails	Retain Existing
23.	Guides	Retain Existing
24.	Buffers	Retain Existing
25.	Buffer Ladder / Platform	N/A
26.	Car Door Size / Type	Field Verify
27.	Hoistway Door Size / Type	Retain Existing
28.	Master Door Operator	Manual
29.	Entrance Sills	Retain
30.	Tracks / Hangers / Interlocks / Closers	Retain and refurbish to like new condition.
31.	Power Supply	Retain
32.	Wiring and Traveling Cables	Retain
33.	Number of Push Button Risers	One (1)
34.	Hall Operating Fixtures	Retain Existing
35.	Car Operating Fixtures	N/A
36.	Door Protective Device	N/A
37.	Car Enclosure	Retain
38.	Car Doors	New

## 2.2 MANUFACTURERS

### A. Pre-Approved Equipment Manufacturers

1. The following manufacturers' equipment and materials have been pre-approved for use on this project.
2. Other equipment not specifically mentioned shall be considered for approval on an individual basis.
3. Certain Original Equipment Manufacturers equipment is acceptable unless otherwise specified.
  - a. Controller - Motion Control Engineering (MCE), Courion Mfg.
  - b. Door Control and related - Courion Mfg.
  - c. Tracks, Hangers, Interlocks and Door Operators - Courion.
  - d. Fixtures - G.A.L., Adams, EPCO, Monitor, E-Motive USA, C.E. Electronics, Innovation, PTL, MAD, National, Matot.
  - e. Door Protective Device - Courion,
  - f. Cabs and Entrances/Entrance Door Panels - Accurate Elevator Door Corp, EDI/ECI, National Cab & Door, Tyler, Velis, Gunderlin, Premier, Prestige, Regency, Matot, Courion.
  - g. Electrical Traveling Cables - Draka, James Monroe
  - h. Governor: Hollister Whitney, MCE, approved equal
  - i. Buffers: Hollister Whitney, MCE, approved equal
  - j. Dumbwaiter Doors and Systems -, Courion, approved equal
  - k. Guide Shoes/Rollers - Matot, ELSCO, G.A.L.
  - l. Wire Ropes - Paulsen, Bethlehem, Wayland, Draka, Brugg.
  - m. Cab Vendors: Courion, approved equal.

### 2.3 CONTROL FEATURES / OPERATION

#### A. Control Equipment (Retain Existing)

1. Retain the existing controllers modify for new door control and update as required to meet code compliance and VA requirements.
2. The controller vendor shall be able to provide immediate 24/7 tech support.
3. Controller parts shall be available for overnight delivery mail, including any parts necessary for maintenance.
4. Digital logic shall calculate optimum acceleration, deceleration and velocity patterns for the car to follow during each run.
5. System operating software shall be stored in non-volatile, electrically programmable read only memory (EPROM), electrically erasable and programmable read only memory (EEPROM), or flash read only memory (flash ROM).

- a. Elevator control relays, contactors, switches, capacitors, resistors, fuses, circuit breakers, overload relays, power supplies, circuit boards, static motor drive units, wiring terminal blocks and related components shall be totally enclosed inside a free-standing metal cabinet with hinged access doors.
- b. All electrical wiring inside the control equipment cabinet shall be performed in a neat manner with field wiring terminated at stud blocks provided inside the control cabinet.
- c. Each wiring terminal shall be clearly identified according to the nomenclature used on the "as built" wiring diagrams. No more than two (2) field wires may be connected to any single terminal stud.
- d. Spare wires shall be tagged according to their point of termination, bundled, and placed at the bottom of the control equipment cabinet.
- e. Each electrical component within the cabinet shall be permanently identified with symbols, identical to those used on the "as-built" wiring diagrams.
- f. A data plate that indicates the edition of the Code in effect at the time of installation and/or alteration shall be provided in accordance with applicable code and requirements of ASME A17.1 Code. The data plate shall be in plain view and securely attached on the mainline disconnect or on the controller.
- g. Control equipment shall comply with requirements of all applicable Sections of the ASME A17.1 Code as approved and adopted by the AHJ.

B. CALL AND SEND operation: Cart Lift Retain

1. Dispatch cart from make-up area level to designated floor and return.
2. Cart shall be manually placed on cart lift platform.
3. Destination button activation shall illuminate that button indicating call registration.
4. Sequence of Operation:
  - a. Hoistway and cart lift doors shall automatically close.
  - b. Cart lift shall proceed to the designated floor.
  - c. Arrival lantern shall light and sound prior to the door's opening.
  - d. Hoistway and cart lift doors shall open automatically.
  - e. Remove cart manually from cart lift.
  - f. Hoistway and car doors shall close automatically or manually by pressing the door close button.
  - g. Cart lift shall return to the central station floor or answer the next call if one has been placed or remain

at this level and park with its hoistway and car doors closed until another dispatch is made.

- h. If a cart is not unloaded at the destination floor, an adjustable timer, set at between sixty (60) seconds and two hundred forty (240) seconds will close the doors starting with a five (5) second warning buzzer. The car will return to Central Station with the cart.

#### 2.4 CORRIDOR OPERATING STATIONS AND CONTROL PANEL

- A. Operating stations and control panel shall be stainless steel, flush mounted adjacent to hoistway entrances.
  - 1. All faceplates shall have all edges beveled 15 degrees.
  - 2. Fasten all faceplates with non-corrosive stainless steel tamperproof screws.
  - 3. Operating push buttons in faceplates shall be designed so that pressure on contact shall be independent of pressure on operating push button.
  - 4. Each switch and operating device shall have indelible, 6 mm (1/4 in.) high legends to indicate its identity and position.
- B. Provide each floor served by cart lift with a complete set of operating push buttons with 13 mm (1/2 in.) numbers in the face of the button corresponding to the floors served. Push buttons shall not protrude beyond the faceplate when in normal position. Call register lights shall be LED illuminated located within or behind the buttons. Illuminate the floor numeral corresponding to the call registered. Provide an "In Use" light in this panel to show when cart lift is in operation or the door is open.
- C. Provide cart lift with a control panel at the makeup area and at other floors as shown on drawings, containing the following:
  - 1. Key operated "ON/OFF" service switch.
  - 2. "Call" and "Send" buttons to upper floors.
  - 3. Door "Open" and "Close" buttons for maintenance purposes and manual operation.
  - 4. A red LED illuminated indicator light to indicate a malfunction in the system.

#### 2.5 CORRIDOR LANTERN/POSITION INDICATOR

- A. Provide each car with combination corridor lantern/position indicator digital display mounted over the hoistway entrances at each and every floor. Each lantern shall contain a single stroke chime so connected that when the cart lift arrives at a

landing, the chime shall sound momentarily. The lenses in each lantern shall be red LED illuminated. Lanterns shall signal in advance of car lift arrival at the landing. Each lantern shall be equipped with a clearly audible electronic chime which shall sound once for car lift arrival. Audible signal shall not sound when a car lift passes the floor without stopping. Provide adjustable sound level on audible signal. Car riding lanterns are not acceptable.

- B. Provide alpha-numeric digital position indicators directly over hoistway landing entranceways between the arrival lanterns at each and every floor. Indicator faceplate shall be stainless steel. Numerals shall be not less than 25 mm (1 in.) high. Cover plates shall be readily removable for re-lamping.
- C. Provide LED illumination in each compartment to indicate the position and direction the car lift is traveling by illuminating the proper alpha-numeric symbol. When the car lift is standing at a landing without direction established, arrows shall not be illuminated.

#### 2.4 MACHINE ROOM / SECONDARY EQUIPMENT

- A. Microprocessor Documentation
  - 1. Provide and/or obtain complete information on systems' design, component parts, and installation and/or modification procedures, adjusting procedures and associated computer conceptual logic circuitry and field connection.
  - 2. Provide microprocessor upgrading and/or modifications to programs that have been assigned to enhance the operation of the equipment for a period of 10 years after project approval.
- B. Overspeed Governor (Reuse) Clean and Dirty Dumbwaiters
  - 1. The existing centrifugal overspeed governor shall be refurbished, modified and reused. Governor rope gripping jaws shall be adjusted so that no appreciable rope damage or deformation occurs from the stopping action applied during activation.
    - a. The governor shall be provided with a manually reset electrical safety switch, conforming to ASME A17.1 Safety Code as adopted and/or otherwise amended by the AHJ.

- 1) When in the tripped position, this switch shall cause all power to be removed from the hoist motor and machine brake.
  - 2) For static power drive applications, this switch shall be designed to operate in both directions of travel.
2. Following the refurbishing and modification work, the overspeed governor shall be tested in accordance with applicable sections of the ASME A17.1 Safety Code as adopted and/or otherwise amended by the AHJ.
  3. Seal and tag the governor with the running speed, tripping speed and date last tested.
  4. At Contractor's option, a new governor may be substituted and/or provided under the terms of the base Contract.

## 2.5 HOISTWAY EQUIPMENT

### A. Guide Rails / Inserts / Brackets (Reuse)

1. Car and counterweight guide rails, fish plates, rail brackets, backing support and related attachments shall be inspected to determine if unfavorable conditions exist that diminish the structural integrity of any component.
  - a. In the event substandard conditions are disclosed by means of this inspection, the Contractor shall immediately undertake whatever repairs and/or replacements may deem appropriate to remedy the situation.
2. Each stack of guide rails shall be individually examined to determine if excessive compression has occurred from building settlement.
  - a. In the event such conditions are found to exist, each affected stack shall be cut off enough to relieve pressure.
  - b. Jacking bolts shall be provided underneath each stack of both car and counterweight guide rails.
3. Each stack of guide rails shall be realigned so that total deviation from plumb in any direction does not exceed 1/8" over the entire length of the hoistway and that DBG measurements never vary more than .030".
4. As required, car guide rails joints shall be individually filled, filed and sanded in order to eliminate minor variations in adjoining machined surfaces.

B. Electrical Conduit / Wiring / Traveling Cable (New wiring installed shall meet the following requirements)

1. Electrical wiring shall be provided.
  - a. All new wiring shall be stranded copper conductors, manufactured in compliance with ANSI/ASTM B174-71 and UL 62 requirements, and polyvinyl chloride insulation complying with ETT requirements of UL 62 and Article 400 of the National Electric Code.
  - b. Electrical wiring provided for hoistway interlock shall be of a flame retardant type, capable of withstanding temperatures of at least 392 degrees Fahrenheit. Conductors shall be Type SF or equivalent.
  - c. Each run of electrical conduit or duct shall contain no less than 10% spare wires and, in any case, no fewer than two (2) spare wires.
  - d. Crimp-on type wire terminals shall be used where possible. Junction boxes on the car shall be equipped with terminal blocks. Terminal blocks having pressure wire connectors of the clamp type that meet UL 486A requirements for stranded wire may be used in lieu of terminal eyelet connections.
  
2. Traveling cable shall be provided (if needed)
  - a. Each traveling cable shall be provided with a flame and water resistant polyvinyl chloride jacket.
  - b. Electrical wiring shall consist of stranded copper conductors, manufactured in compliance with ANSI/ASTM B174-71 and UL 62 requirements, and polyvinyl chloride insulation complying with ETT requirements of UL 62 and Article 400 of the National Electric Code.
  - c. Each traveling cable shall contain no less than 10% spare wires.
  - d. Traveling cable exceeding 100' in length shall be provided with a steel wire rope support strand from which the cable shall be suspended.
  - e. Traveling cable must be contained within an approved electrical conduit to within 6' of the final suspension point in the hoistway.
  - f. Traveling cable conductors that terminate at a hoistway center box shall be connected to stud blocks provided for that purpose.
    - 1) Each wiring terminal shall be clearly identified by its nomenclature as shown on the "as built" wiring diagrams and solderless, crimp-on type wire terminals shall be used where possible.

- g. The attachment of a traveling cable to the underside of the elevator car shall be performed so that a minimum loop diameter of 30x the cable diameter is provided.
  - h. Pre-hang the cables for at least 24 hours with ends suitably weighted to eliminate twisting during operation.
3. Rigidly supported EMT conduit, flexible metal conduit and galvanized steel trough shall be utilized throughout the hoistway.
- a. Both EMT and flexible conduit shall be connected on either end by use of compression fittings and secured in place with metal clamps sized in accordance with the diameter of conduit utilized.
    - 1) Wire or plastic wire ty-raps shall not constitute an acceptable means of fastening.
  - b. The use of flexible metal conduit shall be limited to runs not greater than 3' in length.
  - c. All abandoned or unused electrical conduit shall be removed from the hoistway.
  - d. If traveling cables come into contact with the hoistway or elevator due to sway or change in position, provide shields or pads to the elevator and hoistway to prevent damage to the traveling cables.
  - e. Hardware cloth wide may be installed from the hoistway suspension point downward to the elevator pit to prevent traveling cables from rubbing or chafing. Hardware cloth shall be securely fastened and tensioned to prevent buckling. Hardware cloth is not required when traveling cable is hung against a flat wall.
  - f. All wiring and electrical connections for security operation in the car shall be terminated on stud blocks in the car operating panel.
  - g. Existing conduit and wiring duct may be reused if suitable for the application.
    - 1) Reuse of existing conduit/duct shall be at the discretion of the Government.
- C. Normal and Final Terminal Stopping Devices (Retain and refurbish)
- 1. Provide normal terminal stopping devices to stop the car automatically from any speed obtained under normal operation within the top and bottom overtravel, independent of the operating devices, final terminal stopping device and the buffers.



2. Provide final terminal stopping devices to stop the car and counterweight automatically from the speed specified within the top clearance and bottom overtravel.
  3. The terminal stopping devices shall have rollers with rubber or other approved composition tread to provide silent operation when actuated by the cam fixed to the top of the car.
    - a. Terminal stopping devices that are not mechanically operated (i.e.: magnetic proximity) shall be provided by the manufacturer of the control equipment, intended for use as a terminal limit, and designed for reliable operation in the hoistway environment.
  4. Final terminal limits shall be pinned so as to prevent movement after final adjustment where required by the AHJ.
- D. Emergency Terminal Speed Limiting Device (Retain and Refurbish)
1. Provide necessary emergency terminal speed limiting devices where reduced stroke buffers are used.
    - a. Operation of the device shall be independent of the operation of the normal terminal stopping device.
    - b. Arrange the device to automatically reduce the car and counterweight speed by removing power from the driving machine motor and brake so that the rated striking speed of the buffer is not exceeded at the time of impact.
    - c. The sensing device shall be independent of the normal speed control system.
    - d. Short circuits caused by grounds or other conditions shall not prevent the operation of the device.

E. Emergency Terminal Stopping Device (Retain)

1. Provide necessary emergency terminal stopping devices where static motor control is used at speeds over 200 feet per minute.
  - a. Operation of the device shall be independent of the operation of the normal terminal stopping device.
  - b. Arrange the device to remove power from the driving machine motor and brake should the normal terminal stopping device fail to cause the car to slow down at the terminal as intended.

2.6 PIT EQUIPMENT

A. Car and Counterweight Buffers (Retain existing)

1. Provide buffer with necessary blocking and horizontal steel braces under the car and counterweight.
2. Provide spring type buffers for Dumbwaiters with operating speeds of up to and including 200 fpm. Use oil buffers for Dumbwaiters with operating speeds over 200 fpm.
3. Use reduced stroke buffer with associated terminal slowdown devices where run by is restrictive.
  - a. Buffer and emergency terminal slowdown device shall operate in accordance with applicable codes.
4. The buffer shall be tested and approved by a qualified testing laboratory prior to installation.
5. Provide a permanent buffer marking plate which indicates the manufacturer's name, identification number, rated impact speed and stroke.
6. Provide a permanent data plate in the vicinity of the counterweight buffer indicating the maximum designed counterweight run by.
7. Support buffers from the pit floor level with all required blocking and bracing steel members.
8. Coordinate the installation of the buffer inspection platform and ladder with the Owner and Construction Manager.

B. Pit Stop Switch (New)

1. Where pit depth does not exceed 67", each elevator pit shall be provided with a push/pull or toggle switch that is conspicuously designated "EMERGENCY STOP" and located so as to be readily accessible from the hoistway entrance on the

lowest landing served at a height of approximately 18" above the floor.

- a. This switch shall be arranged to prevent the application of power to the hoist motor and machine brake when placed in the "OFF" position.

## 2.7 HOISTWAY ENTRANCES

### A. Hoistway Entrances (Reuse)

1. Hoistway entrance sills, sill supports, entrance frames, headers and header supports shall be reused and refurbished.
  - a. Hoistway entrances that have become distorted or bent shall be straightened, plumbed, reset to the proper width dimension and reinforced as necessary.
  - b. Provide 14-gauge steel fascia plates that extend at least the full width of the door and be secured at hanger support and sill with oval head machine screws.
    - 1) Reinforce fascia to allow not more than ½" of deflection.
    - 2) Provide fascia plates where the clearance between the edge of the loading side of the platform and the inside face of the hoistway enclosure exceeds the code allowed clearance.
  - c. Provide 14-gauge steel toe guards that extend 12" below any sill not protected by fascia.
    - 1) The toe guards shall extend the full width of the door and shall return to the hoistway wall at a 15-degree angle and be firmly fastened.
  - d. Install block out plates in entrances that have an inactive switch for hoistway apparatus.
  - e. Remove oil, dirt and impurities on new and existing apparatus and give a factory coat of rust inhibitive paint to all exposed surfaces of struts, hanger supports, covers, fascias, toe guards, dust covers and other ferrous metal.

### B. Slide Type Hoistway Door in Existing Frame bi Parting Doors, (Retain)

1. Retain the existing hoistway entrance door while reusing the existing entrance frame.

2. Provide a special key so that an authorized person can open any landing door when the car is elsewhere.
    - a. The key hole shall be not less than 3/8" in diameter and shall be fitted with a stainless steel or bronze ferrule to match related equipment.
  3. Finish all door panels to match elevator entrances, color as selected by Owner.
  4. Where conditions require, provide necessary new masonry around existing entrance frames to maintain fire rating. Painting or other wall surface decorating will be by other trades as part of this contract.
- C. Tracks / Hangers / Closers / Related Equipment (All Dumbwaiters - Retain and refurbish)
1. Formed or extruded steel landing door hanger tracks shall be retained.
  2. Each landing door panel shall be adjusted or shimmed to provide a smooth operation.
    - a. Hanger assemblies shall be directly mounted to the door panel using 3/8" diameter or better hardware.
    - b. Solid steel blocks shall be used where job-site conditions dictate the use of spacers between hanger assemblies and the landing door panel.
    - c. Hanger assemblies shall be adjusted or shimmed so that door panels are suspended in a plumb manner with no more than 3/8" vertical clearance to the cab entrance threshold.
    - d. Upthrust rollers shall be adjusted for minimal operating clearance against the bottom edge of the hanger track.
    - e. Means shall be provided to prevent hangers from jumping the track.
    - f. Blocks shall be provided to prevent rollers from overrunning the end of the track.
  3. Each set of bi-parting slide landing doors shall be provided with a closing mechanism with necessary door panel relating hardware.
  4. Where applicable, each hoistway door interlock assembly shall be provided with an emergency release mechanism utilizing manufacturers' standard type access key at all landings served.
- D. Interlocks / Unlocking Devices (Retain and refurbish)

1. Each set of landing doors shall be provided with a complete electromechanical interlock assembly.
  - a. Each interlock assembly shall consist of:
    - 1) A switch housing with contacts
    - 2) Lock keeper
    - 3) Clutch engagement/release subassembly
    - 4) Associated linkages
2. Non-typical mounting arrangements for interlocks and/or related mechanisms must receive prior approval from the Government.
3. Each hoistway door interlock assembly shall be provided with an emergency release mechanism utilizing at all landings served.

E. Hoistway Door Guides / Safety Retainers (New)

1. The side(s) of each bi-parting sliding type hoistway door panel shall be equipped with a minimum of two (2) guiding members.
  - a. Metal mounting angles shall be secured to the integral panel frame structure; and when conditions warrant, additional external metal support plates or angles shall be installed to ensure the integrity of the panel frame is not compromised.
  - b. Guides shall be manufactured of low friction non-metal material with sufficient strength to withstand forces placed on door panels per ASME A17.1 Standards.
  - c. Each guide assembly shall incorporate a steel wear indicator and be so designed to permit sliding member replacements without removal of door panel(s) from top hanger devices.
  - d. Panels shall be hung with a maximum vertical clearance of 3/8 inch between top of sill and bottom of panel and the guide shall engage the sill groove by not less than 1/4 inch.

F. Vertical Bi-Parting Hoistway Entrances (Reuse)

1. Existing vertical bi-parting door, frame and appurtenances shall be retained with the following repairs, refurbishing, modifications and component renewals.
  - a. Verify that the integrity of the frame, supporting structures and sill have not been compromised.
  - b. Check vertical track alignment and resecure as necessary.
  - c. Replace door guides.

- d. Repair door panels where distorted, bent or otherwise damaged and reset for proper alignment within track guides.
  - e. Inspect, repair and replace deteriorated guide shoes, chains, chain rods, sill stops, counterweights and related hardware.
2. Replace resilient astragal, damaged pull strap and vision panel where necessary.
  3. Overhaul existing interlock, retiring cam, unlocking device and tension latch. Replace worn component parts.
  4. Provide new interlock assemblies with retiring cam and related apparatus complete.
  5. Replace existing with door closing operator retrofit kit assembly.
  6. Modify existing hoistway door panels with shoes and safety meeting rail, interlocks, limits, lock bars, door sprockets, chains, power operators, car gate panels complete with tracks, chains & operators, retiring cams with motors, hinged sill plates, emergency unlocking devices, CARE infrared reversing devices, and door/gate control for the new Magna Grip upgrade as required by code.
  7. Modify existing platform & car enclosure as needed for CARE infrared and magnagrip upgrade.
  8. Interface existing apparatus with new control for sequential operation in conjunction with power gate functions.

## 2.8 CAR EQUIPMENT / FRAME

### A. Car Frame (Reuse)

1. The existing car frame assembly shall be refurbished to as new condition and reused.
2. Individual car frame members, platform isolation framework, door operator support structure, related bracing and hardware shall be inspected for any indication of damage or distortion.
  - a. Where damage is detected, the Contractor shall immediately inform the Government and then undertake corrective action deemed appropriate by the Government to remedy the condition.
3. Provide new elastomer isolation pads for all existing platforms where pads are presently installed.
4. The car frame, door operator support and related bracing shall be modified or reconfigured as necessary in order to accommodate new Courion door operator system.

5. The elevator car shall undergo static balancing upon substantial completion of all work described in the project specifications and subsequent to any car interior refinishing or cab replacement work performed in conjunction with the project.

B. Car Platform (Modify as required)

1. The existing platform shall be modified to accommodate the new apparatus specified herein.
  - a. Where necessary, the underside of platform shall be refurbished and treated with fire-rated material.
  - b. The cab platform and door related hardware will be modified to accommodate the upgraded magna-grip feature. All related hardware will be engineered to meet the requirements for this added feature, as well as meet the requirements for code compliance.
  - c. At Contractor's option or when conditions warrant, provide a totally new platform in lieu of repairs, modifications and upgraded specified above.

C. Automatic Leveling / Releveling / Positioning Device (Retain)

1. Equip the elevator with a floor leveling device which shall automatically bring the car to a stop within 1/4" of any floor for which a stop has been initiated regardless of load or direction of travel.
2. This device shall also provide for releveling which shall be arranged to automatically return the elevator to the floor in the event the elevator should move below or above floor level in excess of 1/4".
3. This device shall be operative at all floors served and whether the hoistway or car door is open or closed provided there is no interruption of power to the elevator.
4. A positioning device shall be part of the controller microprocessor systems.
  - a. Position determination in the hoistway may be through fixed tape in the hoistway or by sensors fitted on each driving machine to encode and store car movement.
  - b. Design the mechanical features and electrical circuits to permit accurate control and rapid acceleration and retardation without discomfort.

D. Car Enclosure Work Light (LED)/ Receptacle

1. The top and bottom of each car shall be provided with a permanent lighting fixture and 110 volt GFI receptacle.

2. Light control switches shall be located for easy accessibility from the hoistway entrance.
3. Where sufficient overhead clearance exists, the car top lighting fixture shall be extended no less than 24" above the crosshead member of the car frame.
4. LED Light bulbs shall be guarded so as to prevent breakage or accidental contact.

E. Car Door Panel(s) (New - Part of Magna Grip upgrade)

1. Provide stainless steel #304, #4 finish stainless steel doors, UL 1 ½ hour "B" labeled flush construction panel(s), reinforced for power operation and insulated for sound deadening.
2. Each pair of doors has a 3" diameter vision panel. Each vision panel is ¼" thick with code compliant wire glass.
3. The panels shall have no binder angles and welds shall be continuous, ground smooth and invisible.
4. Drill and reinforce panels for installation of door operator hardware, door protective device, door gibs, etc.
  - a. Provide each door panel with two removable guides, arranged to run in the tracks with minimum clearance.
  - b. The guide mounting shall permit their replacement without removing the door from the hangers.

F. Door Reopening Device (New Clean and Dirty only lifts only)

1. Provide an infrared door reopening device.

G. Replace existing door operator with Magna Grip retrofit assembly.

- a. Replace all car guides and tracks as required for the installation of the retrofit.
- b. Modify cab as needed for tracks and guides for the installation of the retrofit.

## 2.9 FINISH AND MATERIALS

A. Hoistway Entrances Finish and Design (retain existing)

1. Hoistway entrances and door panels shall be Retained and refinished to remove scratches and dents.

B. Car Interior Finishes

1. Car interior finishes shall be refurbished to like new condition.



C. Material, Finishes and Painting

1. General

- a. Cold-rolled Sheet Steel Sections: ASTM A366, commercial steel, Type B
- b. Rolled Steel Floor Plate: ASTM A786
- c. Steel Supports and Reinforcement: ASTM A36
- d. Aluminum-alloy Rolled Tread Plate: ASTM B632
- e. Aluminum Plate: ASTM B209
- f. Stainless Steel: ASTM A167 Type 302, 304 or 316
- g. Stainless Steel Bars and Shapes: ASTM A276
- h. Stainless Steel Tubes: ASTM A269
- i. Aluminum Extrusions: ASTM B221
- j. Nickel Silver Extrusions: ASTM B155
- k. Bronze Sheet: ASTM B36 (36M) alloy UNS No. C2800 (Muntz Metal)
- l. Structural Tubing: ASTM A500
- m. Bolts, Nuts and Washers: ASTM A325 and A490
- n. Laminated / Safety Tempered Glass: ANSI Z97.1

2. Finishes

- a. Stainless Steel
  - 1) Satin Finish: No. 4 satin, long grain
- b. Sheet Steel:
  - 1) Shop Prime: Factory-applied baked on coat of mineral filler and primer
  - 2) Finish Paint: Two (2) coats of low sheen baked enamel, color as specified.
  - 3) Steel Equipment: Two (2) coats of manufacturer's standard rust-inhibiting paint to exposed ferrous metal surfaces in both the hoistway and pit that do not have galvanized, anodized, baked enamel, or special Architectural finishes.

3. Painting

- a. Apply two (2) coats of paint to the machine room floor.
- b. Apply two (2) coats of clear lacquer to bronze or similar non-ferrous materials to prevent tarnishing during a period of not less than twelve (12) months after initial acceptance by the Owner or Agent.
- c. Identify all equipment including buffers, crosshead, safety plank, machine, controller, drive, governor, disconnect switch, etc., by 4" high numerals which shall contrast with the background to which it is

applied. The identification shall be either decalcomania or stencil type.

- d. Paint or provide decal-type floor designation not less than six (6) inches high on hoistway doors (hoistway side), fascias and/or walls as required by A17.1 Rule 100.7 at intervals not exceeding 7'-0". The color of paint used shall contrast with the color of the surface to which it is applied.

D. Designation and Data Plates, Labeling and Signage.

1. Provide an elevator identification plate on or adjacent to each entrance frame where required by the AHJ.
  - a. The designation numeral shall be a minimum of 3" in height.
2. Provide Dumbwaiters with data and marking plates, labels, signages and refuge space markings complying with A17.1 Elevator Safety Code as may be adopted and/or otherwise modified by the AHJ.
3. Owner shall select the designation and data plates from manufacturer's premium line of plates.

2.10 FIXTURES / SIGNAL EQUIPMENT (Retain)

A. General - Design and Finish

1. The design and location of the hall and signaling fixtures shall comply with the ADAAG.
2. The operating fixtures shall be selected from the manufacturer's premium line of fixtures.
3. The operating fixtures for the Service Dumbwaiters 5 & 6 will be selected from the manufacturer's premium line of vandal resistant fixtures.
4. A sample of the fixture buttons will be provided to the owner and VDA, prior to production.
5. Custom designed operating and signaling fixtures shall be as shown on the drawings or as approved by the Owner/VDA.
6. Custom designed operating and signaling fixtures shall be as shown on the drawings or as approved by the Owner / Owner.
7. The layout of the fixtures including all associated signage and engraving shall be as approved by the Government and the VA Owner's Representative.
8. Mount fixtures with tamperproof or concealed fasteners and service elevator fixtures with tamperproof screws. The screw and key-switch cylinder finishes shall match faceplate finish.

9. Where key-operated switch and or key-operated cylinder locks are furnished in conjunction with any component of the installation, four (4) keys for each individual switch or lock shall be furnished, stamped or permanently tagged to indicate function.
10. All caution signs, code mandated instructions and directives shall be engraved and filled with epoxy.

B. Corridor Push Button Stations / Riser (Retain)

1. A riser of push button signal fixtures shall be provided on all floors.
2. Each signal fixture shall consist of the following:
  - a. A flush-mounted faceplate.
  - b. Illuminating tamper-resistant push buttons measuring 3/4" at their smallest dimension as selected by the Owner.
  - c. A recessed mounting box, electrical conduit and wiring.
3. Push button signal fixtures shall be installed at a centerline height of 42" above the floor and shall be installed both plumb and flush to the finished wall.
4. Fixture faceplates shall be installed adjacent to the entrance frame on front wall.
5. All cutting, patching, grouting and/or plastering of masonry walls resulting from the removal or installation of corridor fixtures shall be performed by the Contractor so as to maintain the fire rating of the hoistway.
  - a. Finished painting or decorating of wall surfaces shall be by other trades as part of this contract.

C. Hall Direction Lanterns / Floor Position Indicators (Retain)

1. Provide a visual and audible signal at each entrance to indicate the direction of travel and, where applicable, which car shall stop in response to the hall call.
  - a. Design the lantern with up and down indication at intermediate landings and a single indication at terminal landings.
  - b. Lanterns shall sound once for the up direction and twice for the down direction.
    - 1) Provide an electronic chime with adjustable sound volume.
  - c. Provide adjustable signal time (3 to 10 seconds, with 1 second increments) to notify passengers which car shall

answer the hall call and preset per ADAAG distance standards.

2. All floors shall include a fixture that shall incorporate a 2" high LED floor position indicator in the hall lantern fixture with direction arrows located on both sides of the indicator.
3. Locate the lantern above / adjacent to the corridor entrance. Final location as shown on the drawings.

## 2.11 CAR ENCLOSURES

### A. Dumbwaiter/Cart Lift Cab

1. Car Shell and Panels (retain and modify for magna grip upgrade)
  - a. The car sides and rear wall shall be Retained and modified as necessary to accept the new Courion door operator system. All finishes shall be returned to like new condition upon completion.
  - b. The car top shall be of no less than No. 12-gauge sheet steel suitably braced to meet the requirements of the A17.1 Code and painted white.
2. Entrance Sill (Retain)
  - a. Retain existing sill.
3. Lighting (Retain existing)
  - a. Provide protective covers that allow service/maintenance from inside the cab area and sufficient to provide code-required lighting within the cab.
4. Flooring: (Retain Existing)
  - a. Replace any damaged subflooring for acceptance new flooring. Thickness to be determined with the flush mounting requirements of the car sill.
5. Lighting: Retain existing.
6. Accessories: Modify the elevator cab to accommodate the door operator, hangers, interlocks and all accessory equipment provided under other sections of these specifications.
7. All new cab materials shall conform to the code prescribed flame spread rating and smoke development requirements.

B. Cab Fabrication and Installation

1. Cab Doors: Stainless steel with No.4 finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspection

1. Study the Contract Documents with regard to the work as specified and required so as to ensure its completeness.
2. Examine surface and conditions to which this work is to be attached or applied and notify the Owner in writing if conditions or surfaces are detrimental to the proper and expeditious installation of the work. Starting the work shall imply acceptance of the surfaces and conditions to perform the work as specified.
3. Verify measurements at the job site, dimensions affecting the work. Bring field dimensions which are at variance with those on the accepted shop drawings to the attention of the Owner. Obtain the decision regarding corrective measures before the start of fabrication of items affected.
4. Cooperate in the coordination and scheduling of the work of this section with the work of other sections so as not to delay job progress.

3.2 INSTALLATION

A. Installation

1. Modernize the Dumbwaiters, using skilled personnel in strict accordance with the final accepted shop drawings and other submittals.
2. Comply with the code, manufacturer's instructions and recommendations.
3. Coordinate work with the work of other building functions for proper time and sequence to avoid delays and to ensure right-of-way of system. Use lines and levels to ensure dimensional coordination of the work.
4. Accurately and rigidly secure supporting elements within the shaftways to the encountered construction within the tolerance established.
5. Provide and install motor, switch, control, safety and maintenance and operating devices in strict accordance with the submitted wiring diagrams and applicable codes and regulations having jurisdiction.

6. Ensure sill-to-sill running clearances do not exceed 1 ¼" at all landings served.
7. Arrange door tracks and sheaves so that no metal-to-metal contact exists.
8. Reinforce hoistway fascia to allow not more than 1/2" of deflection.
9. Install elevator cab enclosure on platform plumb and align cab entrance with hoistway entrances.
10. Sound isolate cab enclosure from car structure. Allow no direct rigid connections between enclosure and car structure and between platform and car structure.
11. Isolate cab fan from canopy to minimize vibration and noise.
12. Remove oil, dirt and impurities and give a factory coat of rust inhibitive paint to all exposed surfaces of struts, hanger supports, covers, fascia, toe guards, dust covers and other ferrous metal.
13. Prehang traveling cables for at least 24 hours with ends suitably weighted to eliminate twisting after installation.
14. Pack openings around oil line with fire resistant, sound isolating glass or mineral wool.
15. After installation, touch up in the field, surfaces of shop primed elements which have become scratched or damaged.
16. Lubricate operating parts of system as recommended by the manufacturer.

### 3.3 FIELD QUALITY CONTROL

#### A. Inspection and Testing

1. Upon completion of each work phase or individual elevator specified herein, the Contractor shall, at its own expense, arrange and assist with inspection and testing as may be required by the VA.

#### B. Substantial Completion

1. The work shall be deemed "Substantially Complete" for an individual unit or group of units when, in the opinion of the Government, the unit is complete, such that there are no material and substantial variations from the Contract Documents, and the unit is fit for its intended purpose.
2. Governing authority testing shall be completed and approved in conjunction with inspection for operation of the unit; a certificate of operation or other required documentation issued; and remaining items mandated for final acceptance completion are limited to minor punch list work not incorporating any life safety deficiencies.

3. The issuance of a substantial completion notification shall not relieve the Contractor from its obligations hereunder to complete the work.
4. Final completion cannot be achieved until all deliverables, including but not limited to training, spare parts, manuals, and other documentation requirements, have been completed.

C. Contractor's Superintendent

1. The Contractor shall assign a competent project superintendent during the work progress and any necessary assistant, all satisfactory to the Owner. The superintendent shall represent the Contractor and all instructions given to him shall be as binding as if given to the Contractor.
2. In accordance with RAF 52.236-6, at all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the worksite a competent superintendent who is satisfactory to the Contracting Officer and has authority to act for the Contractor.

3.4 PROTECTION / CLEANING

A. Protection and Cleaning

1. Adequately protect surfaces against accumulation of paint, mortar, mastic and disfiguration or discoloration and damage during shipment and installation.
2. Upon completion, remove protection from finished surfaces and thoroughly clean and polish surfaces with due regard to the type of material. Work shall be free from discoloration, scratches, dents and other surface defects.
3. The finished installation shall be free of defects.
4. Before final completion and acceptance, repair and/or replace defective work, to the satisfaction of the Owner, at no additional cost.
5. Remove tools, equipment and surplus materials from the site.
6. Any existing material that is not used for the modernization project is to be removed before the final completion, including all material currently located in the machine room, hoistways, secondary spaces and pits.

B. Barricades and Hoistway Screening

1. The Contractor shall provide barricades where necessary in order to maintain adequate protection of areas in which work specified by the Contract Documents is being performed, including open hoistway entrances. Fabrication and erection as all barricades shall be in compliance with applicable OSHA regulations.
2. As required, the Contractor shall provide temporary wire mesh screening in the hoistway and of any elevator undergoing work specified in the Contract Documents. This screening shall be installed in such a manner as to completely segregate the hoistway from that of adjacent Dumbwaiters. Screening shall be constructed from .041" diameter wire in a pattern that rejects passage of a 1" diameter ball.

C. Pre-Tests and Acceptance Testing

1. Comply with the requirements of Division 01.
2. The Contractor shall provide at least five (5) days prior written notice to the Owner and Consultant regarding the exact date on which work specified in the Contract Documents will reach completion on any single unit of vertical transportation equipment.
3. Pre-test the dumbwaiter and related equipment in the presence of the Resident Engineer or his authorized representative for proper operation before requesting final inspection. Conduct final inspection at other than normal working hours, if required by Resident Engineer.
4. Procedure outlined in the Inspectors Manual for Electric Elevators, ASME A17.2 shall apply.
  - a. Final test shall be conducted in the presence of and witnessed by an ASME QEI-1 Certified Elevator Inspector.
  - b. Government shall furnish electric power including necessary current for starting, testing, and operating machinery of each dumbwaiter.
5. Contractor shall furnish the following test instruments and materials on-site and at the designated time of inspection: properly marked test weights, voltmeter, amp-meter and amp probe, thermometers, direct reading tachometer, and a means of two-way communication.
6. Inspection of workmanship, equipment furnished, and installation for compliance with specifications.
7. Balance Tests: The percent of counterbalance shall be checked by placing test weights in car until the car and



counterweight are equal in weight when located at the mid-point of travel. If the actual percent of counter balance does not conform to the specification, the amount of counterweight shall be adjusted until conformance is reached.

8. Full-Load Run Test: Dumbwaiter shall be tested for a period of one hour continuous run with full contract load in the car. The test run shall consist of the dumbwaiter stopping at all floors, in either direction of travel, for not less than five or more than ten seconds per floor.
9. Speed Test: The actual speed of the dumbwaiter shall be determined in both directions of travel with full contract load, balanced load and no load in the dumbwaiter. The actual measured speed of the dumbwaiter with all loads in either direction shall be within three (3) percent of specified rated speed. Full speed runs shall be quiet and free from vibration and sway.
10. Temperature Rise Test: The temperature rise of the hoisting motor shall be determined during the full load test run. Temperatures shall be measured by the use of thermometers. Under these conditions, the temperature rise of the equipment shall not exceed 50 degrees Centigrade above ambient temperature. Test shall start when all machine room equipment is within five (5) degrees Centigrade of the ambient temperature. Other tests for heat runs on motors shall be performed as prescribed by the Institute of Electrical and Electronic Engineers.
11. Car Leveling Test: Dumbwaiter leveling devices shall be tested for accuracy of leveling at all floors with no load in car in car and with contract load in car, in both directions of travel. Accuracy of floor level shall be within plus or minus 3 mm (1/8 in.) of level with any landing floor for which the stop has been initiated regardless of load in car or direction of travel. The car leveling device shall automatically correct over travel as well as under travel and shall maintain the car floor within plus or minus 3 mm (1/8 in.) of level with the landing floor regardless of change in load.
12. Brake Test: The action of the brake shall be prompt and a smooth stop shall result in the up and down directions of travel with no load and rated load in the elevator. Down stopping shall be tested with 125 percent of rated load in the dumbwaiter.
13. Insulation Resistance Test: The dumbwaiter's complete wiring system shall be free from short circuits and grounds and the insulation resistance of the system shall be determined by use of megohm meter, at the discretion of the Inspector conducting the test.

14. Safety Devices: Car and counterweight safety devices shall be tested.
15. Overload Devices: Test all overload current protection devices in the system at final inspection.
16. Limit Stops: The position of the car when stopped by each of the normal limit stops with no load and with contract load in the car shall be accurately measured.
17. Final position of the dumbwaiter relative to the terminal landings shall be determined when the dumbwaiter has been stopped by the final limits. The lower limit stop shall be made with contract load in the dumbwaiter. Dumbwaiter shall be operated at inspection speed for both tests. Normal limit stopping devices shall be inoperative for the tests.
18. Operating and Signal System: The dumbwaiter shall be operated by the operating devices provided and the operation signals and automatic floor leveling shall function in accordance with requirements specified. Starting, stopping and leveling shall be smooth and comfortable without appreciable steps of acceleration or deceleration.
19. If equipment fails test requirements and a re-inspection is required, the Contractor shall be responsible for the cost of re-inspection; salaries, transportation expenses, and per-diem expenses incurred by the elevator inspector and representative of the Resident Engineer.
20. After hour pre-tests and inspections (with or without the AHJ) of systems such as emergency generators, fire service, and security systems shall be conducted at no extra cost to the Owner.

END OF SPECIFICATION

**SECTION 14 21 00**  
**ELECTRIC TRACTION ELEVATORS**

**PART 1 - GENERAL**

1.1 SUMMARY AND DEFINITIONS

A. Related Documents

1. Section 01 33 23 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
2. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-rated construction.
3. SECTION 09 06 00, SCHEDULE FOR FINISHES: As a master format for construction projects, to identify interior and exterior material finishes for type, texture, patterns, color and placement.
4. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirements for seismic restraint of non-structural components.
5. Section 14 99 00, Elevator Maintenance Requirements
6. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.
7. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.
8. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
9. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.
10. Section 26 24 16, PANELBOARDS: Low voltage panelboards.
11. Section 26 51 00, INTERIOR LIGHTING: Fixture and ballast type for interior lighting.

B. Intent

1. This section includes:
  - a. Four (4) gearless traction Passenger Elevators (Bank A)
  - b. Three (3) gearless traction Passenger Elevators (Bank B)
  - c. Two (2) gearless Service Elevators (Elevators No.5 & No. 6)

2. The following outlines the scope of work covered in this section: The complete modernization of the equipment identified herein including but not limited to the replacement of the controllers, power drives, hoist machines and motors, wire rope, car and hall fixtures, new central control panel and wiring as specified.
3. Related equipment shall be designed, constructed, installed and adjusted to produce the highest results with respect to smooth, quiet, convenient and efficient operation, durability, economy of maintenance, and the highest standard of safety.
4. It is not the intent of these specifications to detail the construction and design of all parts of the equipment, but it is expected that the type, materials, design, quality of work and construction of each part shall be adequate for the service required, durable, properly coordinated with all other parts, and in accordance with the best commercial standards applicable and of the highest commercial efficiency possible.
5. Electric and magnetic circuits and related parts shall be of proper size, design and material to avoid heating and arcing, and all other objectionable effects which may reduce the efficiency of operation, economy of maintenance and/or net-useful life of the apparatus.
6. Minimum requirements for design, materials, etc., are for certain parts of the equipment. Equivalent requirements approved by the Government shall apply to such parts as are of special design, construction or material and to which the specified requirements are not directly applicable. These minimum requirements as a whole shall be considered as establishing proportionate general minimum standards for all parts of the equipment.
7. General requirements for design, materials and construction are intended primarily to apply to the heavy-duty and important parts of the equipment specifically mentioned and to other parts of similar duty and importance. Less important and light-duty parts may be of the standard design, materials and construction provided that, in the opinion of the Government, such standards are in accordance with the best commercial practice and are fully adequate for the purpose of use. All such variations shall be made only on the Government's written approval.
8. All equipment and component parts installed, supplied or provided under this contract shall be manufactured and distributed by a third-party, non-installer company servicing the vertical transportation industry.

- a. Apparatus shall conform to the design and construction standards referenced herein, and shall be rated the best commercial grade suitable for this application.
  - b. Equipment and component systems shall not employ any experimental devices or proprietary designs that could hamper and/or otherwise prohibit subsequent maintenance repairs or adjustments by all qualified contractors.
  - c. Manufacturers of the apparatus shall provide technical support and parts replacements for their equipment and component systems for a minimum of twenty (20) years, and issue such guarantee of support to the purchaser with written certification naming the final Owner of their product(s) to ensure the apparatus or systems remain maintainable regardless of who may be selected for future service.
9. All equipment provided shall be factory and field tested with a history of design reliability and net-useful life established.
- a. Contractor must be able to demonstrate the apparatus to be installed has been used successfully in a substantially similar manner under comparable conditions.
  - b. If the apparatus proposed differs substantially in construction, material composition, design, size, capacity, duty or other such rating from the equipment previously used for the same purpose by the manufacturer, the Government may reject the apparatus or require the vendor test and demonstrate the adequacy and suitability for this particular situation. Any necessary tests shall be performed at the sole expense of the Contractor with no prior guarantee of acceptance after the testing procedure.
10. The Contractor shall not use as part of the permanent equipment any experimental devices, proprietary design, components; construction of materials which have not been fully tried out in at least substantially similar or under comparable service, except as may be especially approved by the Government. If any important equipment or devices to be used on this installation differ substantially in construction, materials, design, size, capacity or duty from corresponding items previously used for the same purpose by the manufacturer, they shall pass such tests as the Government may require to fully show their adequacy and suitability. These tests shall be in addition to tests herein specified and shall be made at the expense of the Contractor.

11. Certain design limitations, tests, etc., are herein specified as a partial check of the adequacy of design, construction and materials used. These requirements do not cover all features necessary to ensure satisfactory and approved operation, etc., of the equipment.
12. It is understood, the entire system shall be designed, fabricated, modified and/or upgraded in full compliance with applicable local laws and code standards and government requirements. The absence of a particular item or requirement shall not relieve the Contractor of the full and sole responsibility for such equipment, features and/or procedures.
13. The Specifications are intended to include all engineering, material, labor, testing, and inspections needed to achieve work specified by the Contract Documents. Inasmuch as it is understood that any incidental work necessary to complete the project is also covered by the Specifications, bidders are cautioned to familiarize themselves with the existing job site conditions. Additional charges for material or labor shall not be permitted subsequent to execution of the Contract.
14. Bidders must report discrepancies or ambiguities occurring in the Specifications to the Government for resolution prior to the bidding deadline, otherwise the Specifications shall be deemed acceptable in their existing form.

C. Abbreviations and Symbols

1. The following abbreviations, Associations, Institutions, and Societies may appear in the Project Manual or Contract Documents:

AHJ	Authority Having Jurisdiction
AIA	American Institute of Owners
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
FAR	Federal Acquisition Regulations
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Agency
OSHA	Occupational Safety and Health Act
VAMC	Veterans Administration Medical Center
PDF	Portable Document Format
CAD	Computer Aided Design

D. Codes and Ordinances / Regulatory Agencies

1. Work specified by the Contract Documents shall be performed in compliance with applicable Federal ordinances in effect at the time of Contract execution. Elevator installation shall meet the requirements of the latest editions published and adopted by the United States Department of Veterans Affairs on the date contract is signed. Regulations of the Authority Having Jurisdiction shall be fulfilled by the Contractor and Subcontractors. The entire installation, when completed, shall conform with all applicable regulations set forth in the latest editions of:
  - a. Site Safety Manual (Construction and Maintenance Documents) including site safety manual acknowledgement and verification requirements.
  - b. Local and/or State laws applicable for logistical area of project work.
  - c. Building Code applicable to the AHJ.
  - d. Elevator Code applicable to the AHJ.
  - e. Safety Code for Elevators and Escalators, ASME A17.1 and all supplements as modified and adopted by the AHJ.
  - f. Safety Code for Elevators and Escalators, A17.1S supplement to A17.1 as modified and adopted by the AHJ for Machine Room Less installations (MRL).
  - g. Guide for Inspection of Elevators, Escalators, and Moving Walks, ASME A17.2.
  - h. Safety Code for Existing Elevators and Escalators, ASME A17.3 as modified and adopted by the AHJ.
  - i. Guide for emergency evacuation of passengers from elevators, ASME A17.4.
  - j. National Electrical Code (ANSI/NFPA 70).
  - k. American With Disabilities Act - Accessibility Guidelines for Building and Facilities and/or A17.1 Accessibility as may be applicable to the AHJ.
  - l. ASME A17.5/CSA-B44.1 - Elevator and escalator electrical equipment.
  - m. VAMC Standards.
  - n. VA Barrier Free Design Guide PG\_18\_13
  - o. International Building Code (IBC)
  - p. National Fire Protection Association:
    - 1) NFPA 13-10: Standard for the installation of Sprinkler Systems
    - 2) NFPA 70-11: National Electrical Code
    - 3) NFPA 72-10: National Fire Alarm and Signaling Code
    - 4) NFPA 101-09: Life Safety Code
    - 5) NFPA 252-08: Fire Test of Door Assemblies

- q. American Society for Testing and Materials (ASTM):
  - 1) A1008/A1008M-10, Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength
  - 2) Low Alloy and High Strength Low-Alloy with Improved Formability
  - 3) E1042-02(R2008), Acoustically Absorptive Materials Applied by Trowel or Spray
- r. Society of Automotive Engineers, Inc. (SAE)
  - 1) J517-10, Hydraulic Hose, Standard
- s. Gauges:
  - 1) For Sheet and Plate: U.S. Standard (USS)
  - 2) For Wire: American Wire Gauge (AWG)
- t. American Welding Society (AWS):
  - 1) D1.1-10, Structured Welding Code Steel
- u. National Electrical Manufacturers Association (NEMA):
  - 1) LD-3-05, High Pressure Decorative Laminates
- v. Underwriter's Laboratories (UL):
  - 1) 486A-03, Safety Wire Connectors for Copper Conductors
  - 2) 797-07, Safety Electrical Metallic Tubing
- w. Institute of Electrical and Electronic Engineers (IEEE)
- x. Regulatory Standards: Uniform Federal Accessibility Standards
- y. Federal Specifications (Fed. Spec.):
  - 1) J-C-30B, Cable and Wire, Electrical (Power, Fixed Installation)
  - 2) J-C-580, Cord, Flexible, and Wire, Fixture
  - 3) W-S-610, Splice Connectors
  - 4) W-C-596F, Connector, Plug, Electrical; Connector, Receptacle, Electrical
  - 5) W-F-406E, Fittings for Cable, Power, Electrical and Conduit, Metal, Flexible
  - 6) HH-I-558C, Insulation, Blankets, Thermal (Mineral Fiber, Industrial Type)



- 7) W-F-408E, Fittings for Conduit, Metal, Rigid (Thick Wall and Thin Wall [EMT] Type)
- 8) RR-W-410, Wire Rope and Strand
- 9) TT-E-489J, Enamel, Alkyd, Gloss, Low VOC Content
- 10) QQ-S-766, Steel, Stainless and Heat Resisting, Alloys, Plate, Sheet and Strip

2. The Contractor shall advise the Owner's Representative of pending code changes that could be applicable to this project and provide quotations for compliance with related costs.

#### E. Definitions

1. Defective Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Definitions in ASME A17.1 as amended or modified by the AHJ apply to work of this Section.

### 1.2 SUBMITTALS

#### A. Submittals

1. Submit in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
2. Prior to beginning the work, the Contractor shall submit and have approved copies of layout drawings, shop drawings and standard cuts. These items shall include:
  - a. A plan view of the hoistway and machine room. Plans shall include a 1/4" = 1'-0" scaled drawing showing room layout including locations of the machine, governor, controller, resistor pack disconnect, utilization equipment, HVAC equipment, etc.
  - b. Plans need to show clearance dimensions and machine control room door swing direction. Plans shall include a 1/4" = 1'-0" scaled elevation drawing of elevator equipment
  - c. Include a 1/8" = 1'-0" architectural plan showing the location of the elevator machine control space and the hoist way. Plan shall show room names, location of space in the building, and corridors.
  - d. Equipment clearances will need to comply with ASME 17.1, Section 2.7 s-2005 and 2011 National Electrical Code, Article 110 and Article 620.

- e. Elevation and placement of equipment in the pit, including reaction of supports and buffer impact loads.
  - f. Top and bottom clearances of overtravel of car and counterweight assemblies.
  - g. Drawings of hoistway entrances and doors showing details of construction and method of fastening to the structural members of the building.
    - 1) If drywall construction is used to enclose hoistway, submit details of interface fastenings between entrance frames and drywall.
  - h. Sill details including sill support.
- 3. Approved filing and submittal requirements must be completed before equipment and related materials are ordered.
  - 4. Copies of Department of Buildings' permits and/or governing authority's documents will be posted at the job site with copies issued to the Owner's Agent, Owner's Representative and Government.
  - 5. Samples of wood, metal, plastic, paint or other architectural finish material applicable to this project shall be submitted for approval by the Owner's designee. Samples shall include the following:
    - a. One (1) each, of stainless steel, 75 mm x 125 mm (3 in. x 5 in.)
    - b. One (1) each, of baked enamel, 75 mm x 125 mm (3 in. x 5 in.)
    - c. One (1) each, of color vinyl floor tile
    - d. One (1) each, of protection pads, 75 mm x 125 mm (3 in. x 5 in.) if used
    - e. One (1) each, car and hoistway Braille plate sample
    - f. One (1) each, car and hall button sample
    - g. One (1) each, car and hall lantern/position indicator sample
    - h. One (1) each, wall and ceiling material finish sample
    - i. One (1) each, car lighting sample
    - j. No other samples of materials specified shall be submitted unless specifically requested after submission of manufacturer's name.
  - 6. Each submittal will indicate the specification section, page, and standard that the product complies with.
  - 7. A rope gripper is being utilized to comply with Ascending Car Protection requirements of the Elevator Code, a submittal drawing showing location of the rope gripper and related pumping unit is required to be submitted for

approval by the manufacturer or Owner's Representative. Preferred location for both units is in the machine room; alternate locations will only be approved if absolutely necessary.

8. Name of manufacturer, type or style designation, and applicable data of the following equipment shall be shown on the elevator layouts:
  - a. Hoisting Machine.
  - b. Hoisting Machine Motor, HP and RPM ratings, Voltage, Starting and Full Load Ampere, and Number of Phases.
  - c. Controller
  - d. Starters and Overload Current Protection Devices.
  - e. Car Safety Device; maximum and minimum rated loads and rated speeds.
  - f. Governor
  - g. Electric Door Operator; HP and RPM ratings, Voltage and Ampere rating of motor.
  - h. Hoistway Door Interlocks.
  - i. Car and Counterweight Buffers; maximum and minimum rated loads, maximum rated striking speed and stroke.
  - j. Hoist and Compensation Ropes; ultimate breaking strength, allowable working load, and actual working load.
  - k. Cab Ventilation Unit; HP rating and CFM rating.
  - l. Complete construction drawings of elevator car enclosure, showing dimensioned details of construction, fastenings to platform, car lighting, ventilation, ceiling framing, top exits, and location of car equipment.
  - m. Complete dimensioned detail of vibration isolating foundations for traction hoisting machines.
  - n. Dimensioned drawings showing details of:
    - 1) All signal and operating fixtures.
    - 2) Car and counterweight roller guides.
    - 3) Hoistway door tracks, hangers, and sills.
    - 4) Door operator, infrared curtain units.
    - 5) Drawings showing details of controllers and supervisory panels.
  - o. Cut sheets and drawings showing details of controllers and supervisory panels.
  - p. Furnish certificates as required under: Paragraph "QUALIFICATIONS".

B. Measurements and Drawings

1. Drawings or measurements included with the bidding material shall be for the convenience of the bidders only and full responsibility for detailed dimensions lies with the Contractor.
2. In the execution of the work on the job, the Contractor shall verify all dimensions with the actual conditions.
3. Where the work of the Elevator Contractor is to join other trades, the shop drawings shall show the actual dimensions and the method of joining the work of the various trades.
4. The successful bidder will submit the stamped structural engineering data for approval to the Government and ownership group, prior to any work being performed on any building structural material.

C. Changes in Scope of Work

1. The Owner may at any time make changes in the specifications, plans and drawings, omit work, and require additional work to be performed by the Contractor.
  - a. Each such addition or deletion to the Contract shall require the Owner and the Contractor to negotiate a mutually acceptable adjustment in the contract price, and, for the Contractor to issue a change order describing the nature of the change and the amount of price adjustment. All changes will be governed by the FAR.
  - b. The Contractor shall make no additions, changes, alterations or omissions or perform extra work except on written authorization of the Owner.
  - c. Each change order shall be executed by the Contractor, Owner, and the Government.

D. Keys

1. Upon the initial acceptance of work specified by the Contract Documents on each unit, the Contractor shall deliver to the Locksmith, six (6) keys for each general key-operated device that is provided under these specifications in accordance with ASME A17.1, Part 8 standards as may be adopted and modified by the AHJ.
2. All other keying of access or operation of equipment shall be provided in accordance with ASME A17.1 Part 8 as may be adopted and modified by the AHJ.
3. All key switches associated with the Fireman's Service features shall be keyed to the ASME A17.1-2010

requirements, including the use of FEOK1 keys in all applicable Firemen's Service key-switch assemblies.

4. Where key-operated switches are furnished in conjunction with any component of this elevator installation, the cylinders shall be keyed to use an IC core that is compatible with Corbin Russwin Large Format Interchangeable Core, 62A1, 6 - Pin Keyway.

E. Diagnostic Tools

1. Prior to seeking final acceptance of the project, the Contractor shall deliver to the Owner any specialized tools required to perform diagnostic evaluations, adjustments, and/or programming changes on any microprocessor-based control equipment installed by the Contractor. All such tools shall become the property of the Owner.
  - a. Owner's diagnostic tools shall be configured to perform all levels of diagnostics, systems adjustment and software program changes which are available to the Contractor.
  - b. Owner's diagnostic tools that require periodic re-calibration and/or re-initiation shall be performed by the Contractor at no additional cost to the Owner for a period equal to the term of the maintenance agreement from the date of final acceptance of the project.
  - c. The Contractor shall provide a temporary replacement, at no additional cost to the Owner, during those intervals in which the Owner might find it necessary to surrender a diagnostic tool for re-calibration, re-initiation or repair.
2. Contractor shall deliver to the Owner, printed instructions, access codes, passwords or other proprietary information necessary to interface with the microprocessor-control equipment.

F. Wiring Diagrams, Operating Manuals and Maintenance Data

1. The manuals shall be submitted in electronic format on non-volatile DVD media, incorporating raw 'CAD' and Acrobat 'PDF' file formats.
2. Manuals, as well as electronic copies, shall contain the following:
  - a. Step-by-step adjusting, programming and troubleshooting procedures that pertain to the solid-state microprocessor-control and motor drive equipment.

- b. Passwords or identification codes required to gain access to each software program in order to perform diagnostics or program changes.
  - c. A composite listing of the individual settings chosen for variable software parameters stored in the software programs of both the motion and dispatch controllers.
  - d. Method of control and operation. Including detailed description of the system logic.
3. Provide four (4) sets three (3) hard copies and one digital of "AS INSTALLED" straight-line wiring, diagrams in both hard and electronic format in accordance with the following requirements:
- a. Displaying name and symbol of each relay, switch or other electrical component utilized including identification of each wiring terminal.
  - b. Electrical circuits depicted shall include all those which are hard wired in both the machine room and hoistway.
  - c. Supplemental wiring changes performed in the field shall be incorporated into the diagrams in order to accurately replicate the completed installation.
4. Furnish four (4) three (3) bound and one digital set of instructions and recommendations for maintenance, with special reference to lubrication and lubricants. All manuals shall be submitted in electronic format on non-volatile DVD media, incorporating raw 'CAD' and Acrobat 'PDF' file formats.
5. Changes made during the warranty period shall be noted on the drawings in adequate time to have the finalized drawings reproduced for mounting in the machine room no later than six months prior to the expiration of the warranty period.

G. Instruction of VA Personnel

1. Provide competent instruction to VA personnel regarding the operation of equipment and accessories installed under this contract, for a period equal to one eight hour day. Instruction shall commence after completion of all work and at the time and place directed by the Resident Engineer.
2. Written instructions in triplicate relative to care, adjustments and operation of all equipment and accessories shall be furnished and delivered to the Resident Engineer in independently bound folders. DVD recordings will also be acceptable. Written instructions shall include correct and legible wiring diagrams, nomenclature sheet of all

electrical apparatus including location of each device, complete and comprehensive sequence of operation, complete replacement parts list of with descriptive literature, and identification and diagrams of equipment and parts. Information shall also include electrical operation characteristics of all circuits, relays, timers, electronic devices, and related characteristics for all rotating equipment.

3. Provide supplementary instruction for any new equipment that may become necessary because of changes, modifications or replacement of equipment or operation under requirements of paragraph entitled "Warranty of Construction".

### 1.3 QUALITY ASSURANCE

#### A. Materials and Quality of Work

1. All materials are to be new and of the best quality of the kind specified.
2. Installation of such materials shall be accomplished in a neat manner and be of the highest quality.
  - a. Should the Contractor receive written notification from the Owner stating the presence of inferior, improper, or unsound materials or quality of installation, the Contractor shall, within twenty-four (24) hours, remove such work or materials and make good all other work or materials damaged.
  - b. Should the Owner permit said work or materials to remain, the Owner shall be allowed the difference in value or shall, at its election, have the right to have said work or materials repaired or replaced as well as the damage caused thereby, at the expense of the Contractor, at any time within one (1) year after the completion of the work; and neither payment made to the Contractor, nor any other acts of the Owner shall be construed as evidence of acceptance and waiver.

#### B. Mechanical Design Requirements (General)

1. The following typical requirements shall apply to all parts of the work where applicable and are supplementary to other requirements noted under the respective headings.
  - a. All bearings, pivots, guides, guide shoes, gearing, door hanger sheaves, door hanger tracks and similar elements subject to friction or rolling wear in the entire elevator installation shall be accurately and smoothly finished and shall be arranged and equipped

for adequate and convenient lubrication. Means shall be provided for flushing and draining the larger bearings and gear case. All oiling holes shall have dustproof, self-cleaning caps.

- b. Bearings of governor and governor sheaves and important supporting bearings of other parts in motion when the elevator is traveling shall, unless otherwise specified or approved, be of ball or roller bearing type.
- c. Bearings for brake levers and similar uses where the amount of movement under load is light and the wear negligible may be unlined.
- d. All plain bearings shall be liberally sized in accordance with the best commercial elevator usages which have proved entirely satisfactory on heavy-duty installations.
- e. Bearings of motors shall be arranged and equipped for adequate automatic lubrication. Ring or chain oilers, spring-fed grease cups and equivalent devices properly used in accordance with the best commercial elevator practice will be acceptable. Approved means shall be provided for visibly checking the amount of lubricant contained and for flushing and draining. Means shall also be provided for preventing leakage of lubricant when the reservoirs or grease cups are filled to proper levels.
- f. Ball and roller bearings shall be of liberal size and of a type and make which have been extensively and successfully used on other similar, heavy-duty elevator installations. They shall be fully enclosed. Loading, lubrication, support and all other conditions of use shall be in accordance with the recommendations of the bearing manufacturer based on previous extensive and satisfactory elevator usage.
- g. All armature spiders and similar items intended to rotate with their shafts shall be keyed and/or firm press or shrunk fit on the shafts. Set screw fastening will be permitted only for minor items not subject to hoisting loads and where means for field adjustment is required.
- h. All bolts used to connect moving parts, bolts carrying hoisting stresses and all other bolts, except guide rail bolts, subject to vibration or shock shall be fitted with adequate means to prevent loosening of the nuts and bolts. Bolts transmitting important shearing stresses between machine parts shall have tight body fit in drilling holes.
- i. All machine work, assembling and installing shall be done by skilled and experienced mechanics using first-class, modern equipment and tools. All work shall be



thoroughly high grade in every respect. All parts will be manufactured to high precision standards so that wearing parts will be readily interchangeable with stock repair parts with a minimum of field fitting.

- j. All bearing and sliding surfaces of shafts, pins, bearings, bushings, guides, etc., shall be smoothly and accurately finished. They shall be assembled and installed in accurate alignment and with working clearance most suitable for the load, speed, lubrication and other conditions of use.
- k. Structural steel used for supporting and securing equipment and for the construction of car slings, etc., shall conform to the A.S.T.M. specification for Structural Steel for Buildings. Design stresses shall not exceed those specified in the local Building Code.
- l. Castings of motor frames, sheaves, gear casings, etc., shall be of the best quality metallurgically controlled, hard, close grained gray machinery cast iron, free from blow holes, sand holes, or shrinkage cracks, ground to remove overruns, sanded and machined so as to leave a finish suitable for its particular application. Surfaces of sheaves and brake drums shall be entirely free from defects and shall show a hardness of not less than 220 Brinell.

C. Electrical Design Requirements (General)

1. The following typical requirements shall apply to all parts of the work and are supplementary to other requirements noted under the respective headings.
  - a. The design and construction of the motors shall conform to the requirements of these specifications and to the ASME Standards for Rotating Electrical Machinery with revisions issued to the first day when the work of this Contract was advertised.
    - 1) Motors shall operate successfully under all loads and speeds and during acceleration and deceleration.
    - 2) Motors shall be designed for quiet operation without excessive heat.
    - 3) Insulation on motor coils and windings and on all insulated switch, relay, brake and other coils shall conform to the requirements for Class "H" insulation, as defined in ASME Standards for Rotating Electrical Machinery. All motors shall be impregnated twice.

- 4) Switches, relays, etc., on controller, starter and signal panels and similar items on other parts of the equipment shall be the latest improved type for the condition of use. They shall function properly in full accordance with the requirements of the machines controlled and with the specified operating requirements of the elevator. Any of these parts showing wear or other injurious effects during the guarantee period to the extent that abnormal maintenance is required or indicated shall be replaced with proper and adequate parts by the Contractor.
- 5) Contacts in elevator motor circuits which are intended to be opened by governors or other safety devices shall be copper to carbon or other approved non-fusing type.
- 6) Where required, controllers and other component parts of the installation shall be labeled in accordance with the latest codes and standards as adopted and/or otherwise modified by the AHJ.
- 7) Electrical equipment, motors, controllers, etc., installed under this contract shall have necessary CSA/US or UL/US listing. Equipment shall be labeled or tagged accordingly.

D. Materials, Painting and Finishes

1. Two (2) coats of rust inhibiting machinery enamel shall be applied to exposed ferrous metal surfaces in the pit that do not have a galvanized, anodized, baked enamel, or special architectural finishes. All retained pit equipment that contains surface rust will be wire wheel brushed, cleaned, and primed with a rust inhibiting primer, prior to coating with two (2) coats of rust-inhibiting machinery enamel.
2. Two (2) coats of rust-inhibiting enamel paint to the machinery located within the machine room and secondary level (where applicable) as well as to the machine room and pit floors.
3. Architectural metal surfaces of bronze or similar non-ferrous materials which are specified to be refinished, re-clad and/or provided new, shall be sufficiently clear coated so as to resist tarnishing during normal usage for a period of not less than twelve (12) months after final acceptance by the Owner.
4. Identify all equipment including buffers, crosshead, safety plank, machine, controller, drive, governor, disconnect switch, etc., by 4" high numerals which shall contrast with

- the background to which it is applied. The identification shall be either decalcomania or stencil type.
5. Paint or provide decal-type floor designation not less than four (4) inches high on hoistway doors (hoistway side), fascias and/or walls as required by Code at intervals not exceeding 7'-0". The color of paint used shall contrast with the color of the surface to which it is applied.
  6. Upon completion of installation and prior to final inspection, all equipment shall be thoroughly cleaned of grease, oil, cement, plaster and other debris. All equipment, except that otherwise specified as to architectural finish, shall then be given two coats of paint of approved color, conforming to manufacturer's standard. Two (2) coats of rust-inhibiting machinery enamel shall be applied to all surfaces of the bottom of the car platform, including bolster channels, stringers, and related hardware.
  7. Hoistway door panels shall be given equivalent rust-resistant treatment and a factory finish of one coat of baked-on primer and one factory finish coat of baked-on enamel.
  8. Fascia plates, top and bottom shear guards, dust covers, hanger covers, and other metalwork, including built in or hidden work and structural metal, (except stainless steel entrance frames and surfaces to receive baked enamel finish) shall be given one approved prime coat in the shop, and one field coat of paint of approved color.
  9. If painting of the equipment becomes disruptive to the staff/patients, arrangements shall be made for the painting to occur after hours which are approved by the Owner. Any overtime fees to do the painting shall be included in the base bid amount.

E. General

1. Cold-rolled Sheet Steel Sections: ASTM A1008, commercial steel, Type "B".
  - a. Shop Prime: Factory-applied baked on coat of mineral filler and primer.
  - b. Finish Paint: Two (2) coats of low sheen baked enamel, color as selected by the Owner.
  - c. Steel Equipment: Two (2) coats of manufacturer's standard rust-inhibiting paint.
2. Steel Supports and Reinforcement: ASTM A36
3. Stainless Steel Bars and Shapes: ASTM A276
4. Stainless Steel Tubes: ASTM A269
5. Aluminum Extrusions: ASTM B221

6. Structural Tubing: ASTM A500
7. Bolts, Nuts and Washers: ASTM A325 and A490.
8. Clear Tempered Glass: ASTM C1048

F. Handicapped Requirements (ADAAG)

1. Locate the alarm button and emergency stop switch at 35", and floor and control buttons not more than 48" above the finished floor. The alarm button shall illuminate when pressed for visual acknowledgement to user.
2. Provide raised markings in the panel to the left of the car call and other control buttons. Letters and numbers shall be a minimum of 5/8" and raised .03" and shall be in contrasting color to the call buttons and cover plate.
3. The centerline of new hall push button shall be 42" above the finished floor.
4. The hall arrival lanterns or cab direction lantern provided shall sound once for the "up" direction and twice for the "down" direction. Design and locate fixtures per Federal standards.
5. Provide floor designations at each entrance on both sides of jamb at a height of 60" above the floor. Designations shall be 2" high, raised .03" on a contrasting color background as selected by the Owner. Any existing Braille plates will be removed and the entrance refinished to like new conditions.
  - a. Use cast metal plates and polished numbers mechanically secured with tamper-proof hardware.
  - b. Designations shall be 2" high, raised .03" on a contrasting color background as selected by the Owner. Surface mounted plates are not acceptable.
6. Provide an audible signal within the elevator to tell passenger that the car is stopping or passing a floor served by the elevator.
7. Where elevators operate at a speed greater than 200 fpm, provide a verbal annunciator to announce the floor at which the elevator is stopping. Provide signal control timing for passenger entry/exit transitions per Federal standards.
8. Ensure sill-to-sill running clearances do not exceed 1-1/4" at all landings served.
9. Provide visual call acknowledgment signal for car emergency intercommunication device.
10. Provide visual signage and indicators for cars identified as code blue medical emergency requirements.

G. Qualifications

1. Approval by the Contracting Officer is required for products and services of proposed manufacturers, suppliers and installers and shall be contingent upon submission of certificates by the Contractor stating the following:
  - a. Elevator contractor is currently and regularly engaged in the installation of elevator equipment as one of his principal products.
  - b. Elevator contractor shall have three years of successful experience, trained supervisory personnel, and facilities to install elevator equipment specified herein.
  - c. Elevator Mechanic (Installer) shall have passed a Mechanic Examination approved by the U.S. Department of Labor and have technical qualifications of at least five years of experience in the elevator industry or 10,000 hours of field experience working in the elevator industry with technical update training. Apprentices shall be actively pursuing Certified Elevator Mechanic status. Certification shall be submitted for all workers employed in this capacity.
2. Approval of Elevator Contractor's equipment will be contingent upon their identifying an elevator maintenance service provider that shall render services meeting the requirements of Section 14.99.00 Elevator Maintenance Requirements included with this document, notification, together with certification that the quantity and quality of replacement parts stock is sufficient to warranty continued operation of the elevator installation.
3. Approval will not be given to elevator contractors and manufacturers who have established on prior projects, either government, municipal, or commercial, a record for unsatisfactory elevator installations, have failed to complete awarded contracts within the contract period, and do not have the requisite record of satisfactorily performing elevator installations of similar type and magnitude.
4. Equipment within a group of electric traction elevators shall be the product of the same manufacturer.
5. The Contractor shall provide and install safety devices that have been subjected to tests witnessed and certified by an independent professional testing laboratory that is not a subsidiary of the firm that manufactures supplies or installs the equipment.
6. Welding at the project site shall be made by welders and welding operators who have previously qualified by test as prescribed in American Welding Society Publications AWS D1.1 to perform the type of work required. Certificates

shall be submitted for all workers employed in this capacity. A welding or hot work permit is required for each day and shall be obtained from the VAMC safety department. Request permit one day in advance.

7. Electrical work shall be performed by a Licensed Master Electrician and Licensed Journeymen Electricians as requirements by NEC. Certificates shall be submitted for all workers employed in this capacity.

#### 1.4 DELIVERY / STORAGE / HANDLING / COORDINATION

##### A. Delivery and Storage of Material and Tools

1. Comply with the requirements of Division 01.
2. Delivery, Storage and Handling:
  - a. Deliver materials to the site ready for use in the accepted manufacturer's original and unopened containers and packaging, bearing labels as to type of material, brand name and manufacturer's name. Delivered materials shall be identical to accepted samples.
  - b. Store materials under cover in a dry and clean location, off the ground.
  - c. Remove delivered materials which are damaged or otherwise not suitable for installation from the job site and replace with acceptable materials.
3. The Owner shall bear no responsibility for the materials, equipment or tools of the Contractor and shall not be liable for any loss thereof or damage thereto.
4. The Contractor shall confine storage of materials on the job site to the limits and locations designated by the Owner and shall not unnecessarily encumber the premises or overload any portion with materials to a greater extent than the structural design load of the Facility.
5. The transportation of material from the storage site to the project will be the responsibility of the elevator contractor.
6. Any requirements for on or offsite storage will be the responsibility of the elevator contractor. Onsite storage costs required for storage containers will be the responsibility of the elevator contractor.

##### B. Work With Other Trades / Coordination

1. Coordinate installation of sleeves, block-outs, equipment with integral anchors, and other items that are embedded in concrete or masonry for the applicable equipment. Furnish

templates, sleeves, equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

2. Coordinate sequence of installation with other work to avoid delaying the Work.
3. Coordinate locations and dimensions of other work relating to elevators including pit ladders, access for hoistway venting including heat and fire smoke sensor placement, sumps in pits; entrance sub sills; beam pocket placement verification, machine beams; and electrical service, electrical outlets, lights, and switches in pits and machine rooms, overhead sheave rooms and hoistways.
4. Coordinate running of the car top access for all contractors for related hoistway work during regular and overtime hours. Costs for running the elevator for contractors will be part of the base bid pricing.
5. Coordinate sequence of installation for group features including dispatching, emergency power, Firemen's service operation, testing, and inspections with the ownership group and or owner's representative.

C. Removal of Rubbish and Existing Equipment

1. On a scheduled basis, the Contractor shall remove from the job site all rubbish generated in performing work specified in the Contract Documents.
2. Any component of the existing elevator plant that is not reused under the scope of work specified in the Contract Documents shall become property of the Contractor and, as such, shall be removed from the premises at the Contractor's sole expense.
3. The Contractor agrees to dispose of the aforementioned equipment and rubbish in accordance with any and all applicable Federal, State, ICRA, and municipal environmental regulations, and further accepts all liability that may result from handling and/or disposing of said material.

D. Protection of Work and Property

1. The Contractor shall continuously maintain adequate protection of all their work from damage and shall protect the Owner's property from injury or loss arising out of this contract.
2. The Contractor shall make good any such damages, injury or loss, except such as may be directly caused by agents or employees of the Owner.
3. The Contractor shall provide full height, lockable barricades required to protect open hoistways or shafts per

OSHA regulations. Such protection shall include any necessary guards or other barricades for employee protections during and after the modernization procedure.

4. See General requirement, Section 01 00 00.

## 1.5 RELATED WORK

### A. Related Work to be included in the Base Bid

1. The following requirements shall be applicable based on prevailing conditions at the site of work and/or mandated modifications for code compliance.
  - a. Submission of Site Safety Manual for Construction and Maintenance Documents, including site safety manual acknowledgement and verification requirements.
  - b. Interface building fire smoke signal, wiring, controls, and telephone in machine room junction box.
  - c. Coordinate all related work by sub-contractors, including car top time for other trades to inspect and complete required work in the hoistway, machine room, and pits.
  - d. All elevator access car top time needed for other contractors to complete related work in the elevator shafts, secondary levels, and pits will be included in the base bid pricing. This time includes as needed elevator personnel to run the elevator for other contractors to access the elevator shafts, secondary levels, and pits as needed.
  - e. Interfacing materials and required integration time between the elevator contractor and the card reader contractor for full installation capabilities a card reader system for all elevators. The card reader is to be provided by this contractor and interface with the existing VA system.
  - f. Provide any necessary cutting or patching for the installation of the new machines.
  - g. The elevator contractor is responsible for all rigging, hoisting, crane work, and crane permits, as required, to remove existing equipment from the building and install new equipment. All crane picks / lifts will require a minimum of one-week notice in advance.
  - h. Provide emergency communication means from the machine room to the cab as required by ASME A17.1 or local code. Telephone lines to the machine room for such systems shall be provided by this contractor.
  - i. Where the pit extends more than 3 feet below the sill of the pit access door, provide a permanent fixed metal ladder.



- 1) Ladder shall extend no less than 48" above the sill of the access door. Handgrips shall extend from the ladder to a point no less than 48" above the sill of the access door where the ladder does not comply.
  - 2) The rungs shall be a minimum of 12" wide. Where prevailing conditions prevent a 12" wide rung, the rung may be reduced to no less than 9".
  - 3) The rungs shall be spaced 12" on center.
  - 4) A clear distance of no less than 4-½" from the centerline of the rungs and handgrips to the nearest permanent object in back of the ladder shall be provided.
- j. Provide the following signage, plates and tags:
- 1) Provide access doors to each machinery space with signs that read "ELEVATOR MACHINE ROOM". Letters shall be not less than 2" high. All signage will require prior approval before installed.
  - 2) Provide all required manufacturer data plates and installation-specific tags and signs of the types and styles containing information as required by applicable Codes and Standards as adopted and/or modified by the AHJ.
  - 3) Signage to and on the machine room doors as required by applicable codes.
  - 4) Provide elevator identification numbers at or near the door frames of each elevator in the main fire recall lobbies. Size of numbering and style shall be contingent upon local code requirements or owner's standards.
- k. Provide hoist rope guards at the car and counterweight drop side of the hoisting machine sheave and secondary sheaves to prevent accidental contact with the hoisting ropes. The guard shall extend from the point where the hoisting ropes penetrate the secondary floor to a point beyond where the ropes contact the traction and deflector sheaves. The guards shall be constructed so as to conceal pinch-points between ropes and sheave grooves.
1. Provide a standard railing conforming to Code on the outside perimeter of the car top on all sides where the perpendicular distance between the edges of the car top and the adjacent hoistway enclosure exceeds 300 mm (12 in.) horizontal clearance or as otherwise required by the Authority Having Jurisdiction.

- m. All costs associated with acceptance testing, including all overtime, inspector's fees and re-inspection costs shall be included in the base bid.
- n. If extenuating circumstances (i.e., separating cars, testing, inspection, etc.) require that multiple cars be removed from service simultaneously, the work shall be performed outside of the normal business hours at an agreed-upon time. A minimum of five (5) days advance written notice shall be given to the Owner and Elevator Consultant detailing the reason for needing to remove multiple elevators from service simultaneously along with the estimated down time. The request shall be subject to review and approval by the Owner and Elevator Consultant and all work and associated expenses shall be included as part of the base bid pricing.
- o. Provide the resources and time required to coordinate work and scheduling requirements between all trades to perform the related work required as part of the elevator modernization project.
- p. Provide all necessary work to provide for a complete, legal, code compliant installation.
- q. Subsequent to contract execution, the Contractor shall perform the following procedures and engineering tasks relative to balance loading of system and cab work included under base specification requirements and alternative/optional upgrades:
  - 1) Perform balance load testing to determine existing conditions and requirements applicable to new/modified equipment.
  - 2) Provide data for Purchaser and/or their agents to evaluate any limitations that may be placed on design/finish options due to prevailing conditions or total suspended loading (weigh all cars).
  - 3) All costs to perform the above mentioned balance loading work is to be included in the base bid amount.
- r. Install separation wall(s) between HVAC and mechanical related equipment from elevator equipment in all machine rooms.
- s. Provide code compliant panning or isolation of roof drains in machine room.
- t. Provide code compliant access requirements to get the elevator equipment into the machine rooms, pits, and hoistways. Any modifications to the building will require prior approval with ownership.

- u. Modify and/or replace step access to machine rooms to meet code compliance for rise, step height, and landing requirements. Submittal drawings will be required prior to any modifications of the existing or new equipment.
- v. Provide machinery spaces of the secondary level directly below the machine room with permanent lighting fixtures fitted with protective guards and a duplex GFI receptacle. Illumination shall be no less than 19 foot-candles at floor level. A light control switch must be provided immediately adjacent to the secondary level entrance door/ladder in accordance with code.
- w. Reuse and modify the existing power supplies to utilize the building power for the new controllers. Provide grounding wire for the system, including all disconnects feeders, and transformers, in accordance with NEC. Install locking provisions for circuit breakers as per code. If existing disconnects are not capable of being locked in the open (OFF) position, new mainline and/or auxiliary disconnect switches shall be provided. Any relocation of mainline disconnect switches (new or existing) shall be included.
- x. Install a new disconnecting means for control systems on the upper deck of the machine room that are not within direct sight of the mainline disconnects.
- y. Provide auxiliary power feeds with required distribution load center (circuit breaker panel) for intercommunication, CCTV systems, and cab lighting or other specialty devices existing or to be provided by the Elevator Contractor.
  - 1) Voltage shall be 110 VAC with one 15, Amp circuit breaker or fuse for lighting of each individual elevator car enclosure.
  - 2) Circuit breakers and/or fused disconnects shall be lockable in the "OFF" position in accordance with applicable code.
- z. All lighting fixtures and related switches in the elevator machine room, hoistway, secondary levels, and pits will utilize LED fixtures and lighting.
- aa. Provide all wiring, piping, access panels, and labor as required for the installation of the card readers (car and hall), video cameras, and voice communication system (as applicable), including all fixtures, network switches, lobby, security desk, fire command room, remote panels, and EMS systems. The wiring can include Cat 5 and/or fiber optic, as required. Cameras and card readers to be supplied as part of this contract.

These must be compatible with the existing security and CCTV systems.

- bb. Installation of new permanent LED lighting fixtures with protective guards and 110-volt duplex GFI receptacles inside the machine rooms and secondary levels. The illumination shall be no less than 30 foot-candles at floor level. A light control switch shall be provided immediately adjacent to the machine room entrance door. Provide necessary receptacles as required by Elevator Contractor to supply power to auxiliary elevator equipment and/or remotely located monitors.
- cc. The top surface of any setback or projection in the hoistway that measures 2" or more in width shall be beveled at an angle of not less than 75 degrees from horizontal, constructed from prime painted 14 gauge cold-rolled steel and installed so as to conform with ASME A17.1 elevator safety code as modified by, and/or in addition to codes and standards accepted by the AHJ.
- dd. A light control switch shall be provided immediately adjacent to the machine room stairwell entrance door and top of the stairwell, where applicable.
- ee. Provide each elevator pit with a 110 volt GFI duplex receptacle and a permanent LED lighting fixture equipped with protective guard. Illumination shall be no less than 10 foot-candles at pit floor level. A light control switch shall be provided and so positioned as to be readily accessible from the pit entrance door and/or ladder from the main lobby. The contractor will provide submittals for the design and layout of the fixtures. The fixture locations will be coordinated with the elevator contractor to ensure it does not hinder the operation of the elevator.
- ff. Provide each machine room and pit with new self-closing, self-locking access door(s) where applicable. Locking means shall be spring-type arranged to permit the doors to be opened from the inside without a key.
- gg. Provide new as needed fire emergency control interface provisions for automatic recall of the elevator(s) through operation of the fire detection system. Provisions shall be made for alternate designated fire recall landing with connection contingent on Codes recognized by the local governing authority. The interfacing contacts shall be wired to an electrical junction box located inside each elevator machine room for connection to the elevator control systems. Each wire shall be clearly labeled with its control function. Coordinate the type of interface required for the specific elevator control apparatus.

- hh. All smoke ventilation provisions, including duct work, dampers, fans, fire control interfaces, hoistway vents, and key switches in accordance with local codes, shall be reviewed for proper operation and restored, or new provisions provided as required. Any other existing vents of unknown purpose shall be modified/deleted as per the AHJ and/or VA requirements.
- ii. Installation of full sprinkler system as required per code, Federal requirements, and VA Standard guidelines for Healthcare facilities. Where sprinkler fire protective systems are provided inside any elevator hoistway, machine room, pit area, or associated machinery space, provisions shall be made for the disconnecting of the main line power supply from the affected elevator prior to activation. This means of disconnect shall be manually reset in accordance with code. Modifications to the existing sprinkler systems to comply with the requirements of the pit, hoistway, and machine room will be included as part of the specifications, including demolition of existing piping in the elevator pits.
- jj. Installation of emergency power control interface provisions to signal the elevator control apparatus of a transfer from normal (utility) power to the building emergency (generator) power supply. Also, provide additional control interface to give advanced notification to the elevator control apparatus that the power source will transfer from emergency (generator) power to normal (utility) power. Interfacing contacts shall be wired to an electrical junction box located inside each machine room for connection to the elevator control equipment by the Elevator Contractor. Coordinate the type of interface required for the specific elevator control apparatus with the Elevator Contractor.
  - 1) Normal Power/Emergency Power Control Signals consisting of two (2) dry contacts provided by other trades to function as follows:
    - a) One (1) dry contact normally open to make when Normal Power is available. (Logic state of dry contact is to be confirmed by the Manufacturer of the Elevator Control Equipment).
    - b) One (1) dry contact normally open to make when emergency power is available. (Logic state of dry contact is to be confirmed by the

Manufacturer of the Elevator Control Equipment).

- kk. Modification to existing or installation of new HVAC provisions so as to maintain ambient temperature and humidity levels that are within the range specified by the microprocessor-control equipment manufacturers. Relocate any HVAC and condensation lines currently passing over controllers and power supplies in the machine room.
- ll. Provide a class "ABC" fire extinguisher in electrical machinery and control spaces. Locate the extinguisher in close proximity to the access door.
- mm. Provide necessary patching, repairing and installation of masonry and/or drywall for smooth and legal elevator hoistways.
- nn. Provide required guarding for pipes, conveying gases, vapors, and liquids in machine room, including panning and barriers for overhead applications as allowed by the AHJ.
- oo. Install a new disconnecting means for control systems the machine room that is not within direct sight of the mainline disconnects.
- pp. The removal and proper abandonment of the existing exhaust fan and all applicable piping and wiring currently located in the elevator machine rooms of all Passenger and Service Elevators. Proper HVAC provisions shall meet the requirements for code compliance.
- qq. All phone wiring is to be placed in conduit and permanently installed in a rated enclosure that allows for future expansion. Remove any and all phone conduit, phone wiring and phone controls in elevator machine room and hoistway associated with the operation of the existing elevators and not required to function with the new elevators and associated controls.
- rr. Ensure all existing machine room escutcheon floor access panels are fully operational. All broken hinges/ closing and locking mechanisms to be inspected for proper operation and repaired as required. All phone wiring is to be placed in conduit and permanently installed in a rated enclosure that allows for future expansion. Remove any and all phone conduit, phone wiring and phone controls in the elevator machine room and hoistway associated with the operation of the existing elevators and not required to function with the new elevators and associated controls.
- ss. Review the existing smoke detector system and provide necessary equipment to comply with the requirements of

A17.1, VA Guidelines, and/or the Local Governing Authority. Provide all interface work required. Install all smoke detectors or heat detectors, shunt trip devices and interfaces related to the elevator system, as necessary. All interface work for the installation of the fire panel will need to be coordinated between the elevator contractor and the building facilities, including subcontractors providing the fire alarm panel. Install all smoke detectors or heat detectors, shunt trip devices and interfaces related to the elevator system as necessary.

- tt. Provide each machine room, secondary space and pit with a self-closing, self-locking access door. Locking means shall be spring-type arranged to permit the doors to be opened from the inside without a key.
- uu. Provide necessary receptacles as required by Elevator Contractor to supply power to auxiliary elevator equipment, pit sumps, remotely located monitors, and lobby panels.
- vv. Sumps in pits and machine rooms, where provided, shall be covered. The cover shall be level with the pit floor so as not to produce a tripping hazard.
- ww. Provide necessary telephone wiring with connection to local telephone service for remote elevator monitoring and/or two-way voice emergency communications systems.
  - 1) Terminate the telephone wiring in junction boxes or standard phone jack terminals in the machine room.
  - 2) Coordinate the quantity and termination method of individual phone connections with the Elevator Contractor.
  - 3) Identify each phone line for connection by the Elevator Contractor to the appropriate elevator device(s).
  - 4) Telephone wiring, where required by applicable codes, shall be installed in conduit.

## 1.6 WARRANTY / MAINTENANCE SERVICES

### A. Contract Close-Out, Guarantee and Warranties

- 1. Submit all labor and materials furnished in connection with elevator system and installation to terms of "Warranty of Construction" articles of FAR clause 52.246-21. The one year Warranty shall commence after final inspection, completion of performance test, and upon full acceptance of

the installation and run concurrent with the guarantee period of service.

2. During warranty period if a device is not functioning properly in accordance with specification requirements, more maintenance than the contract requires keeping device operational, device shall be removed and a new device meeting all requirements shall be installed as part of work until satisfactory operation of installation is obtained. Period of warranty shall start anew for such parts from date of completion of each new installation performed, in accordance with foregoing requirements.

B. Maintenance Coverage

1. The following maintenance coverage apply:

a. Interim Maintenance

- 1) Provide full protective maintenance services and equipment coverage beginning with the contract award, during the work implementation procedure, and until final acceptance of the finished project.
- 2) Interim full comprehensive maintenance services shall be provided in accordance with Section 14.99.00 Elevator Maintenance Requirements issued with these documents.
- 3) Costs related to interim maintenance shall be included in the base bid quotation.

b. Guaranty Period Services (GPS)

- 1) Furnish complete maintenance and inspection service on entire elevator systems. The modernized elevator systems shall be guaranteed for a period of one year beginning with the completion and acceptance of the last elevator installation by COR. Maintenance work shall be performed by Certified Elevator Mechanics and Apprentices supervised by the company that is providing the guaranteed period of service on the elevator equipment specified herein.
- 2) The warranty period for each elevator being modernized will start on a per-car basis, as each elevator is handed over with final acceptance to the Government.
- 3) The Guarantee period will cover full maintenance services in compliance with Section 14.99.00



Elevator Maintenance Requirements issued with  
these documents.

**PART 2 - PRODUCTS**

2.1 GENERAL DESCRIPTION - ELEVATORS

A. Passenger Elevators No. 1 - No. 4 (A Bank)

1.	Quantity	Four (4) / Retain
2.	Type	Passenger / Retain
3.	Capacity (lbs.)	4,000 / Retain
4.	Speed (fpm)	500 / Retain
5.	Travel in Feet	Field Verify
6.	Roping/Ropes	2:1
7.	Hoisting	New
8.	Governor	Retain
9.	Compensation	New
10.	Number of Landings	Ten (10) @ B, 1 - 9
11.	Number of Openings	Ten (10) @ B, 1 - 9
12.	Front Openings	Ten (10) @ B, 1 - 9
13.	Rear Openings	N/A
14.	Operation	Automatic Group Collective Operation / New
15.	Control	New Closed Loop, Variable Voltage Variable Frequency AC Regenerative
16.	Fireman's Service	New, as specified
17.	Machine Room, Secondary, Pit Lighting and GFCI	As indicated on plans
18.	Machine Type	New Permanent Magnet AC Gearless Machines
19.	Power Drive	New Solid State VVVF Regenerative New
20.	Machine Location	Above
21.	Governor tail sheave	New
22.	Platform, Safety Plank	Retain Platform and Safeties
23.	Counterweight	Retain Existing
24.	Guide Rails	Retain Existing
25.	Guides	Car and Counterweight / New
26.	Buffers	New
27.	Car Door Size / Type	3' - 6" x 7' - 0" / Two Speed Side Slide
28.	Hoistway Door Size / Type	Same as Car Door
29.	Master Door Operator(s)	New
30.	Car Entrance Sills	Retain Existing / Recondition
31.	Tracks, Hangers	New
32.	Interlocks, Closers	New

- |                                  |   |
|----------------------------------|---|
| 33. Hoistway Doors               | New door panels, retain entrance assembly |
| 34. Top Emergency Exit           | New with new cab                          |
| 35. Power Supply                 | Retain / Modify as required for 208VAC    |
| 36. Wiring and Traveling Cables  | New                                       |
| 37. Card Reader                  | New                                       |
| 38. Number of Push Button Risers | Two (2) / Dual risers                     |
| 39. Hall Operating Fixtures      | New                                       |
| 40. Car Operating Fixtures       | New                                       |
| 41. Communication                | New                                       |
| 42. Door Protective Device       | New                                       |
| 43. Emergency Cab Lighting       | New                                       |
| 44. Car Ventilation              | New                                       |
| 45. Car Enclosure                | New Shell and Cab complete                |
| 46. Car Doors                    | New                                       |
| 47. Car Flooring                 | New / flexible terrazzo tile              |
| 48. Car Sill                     | New / Nickel Silver                       |
| 49. Car position indicator       | New                                       |
| 50. Lobby Panel                  | New                                       |
| 51. Elevator Monitoring System   | New                                       |

B. Service Elevators No. 5 & No. 6

- |  |   |
|--|---|
| 1. Quantity  | Two (2) / Retain  |
| 2. Type  | Service / Retain  |
| 3. Capacity (lbs.)                                 | 5,000 / Retain  |
| 4. Speed (fpm)                                     | 500 / Retain  |
| 5. Travel in Feet                                  | Field Verify  |
| 6. Roping/Ropes                                    | 2:1   |
| 7. Hoisting  | New   |
| 8. Governor  | Retain  |
| 9. Compensation                                    | New   |
| 10. Number of Landings                             | Ten (10) @ B, 1 - 9                                     |
| 11. Number of Openings                             | Ten (10) @ B, 1 - 9                                     |
| 12. Front Openings                                 | Ten (10) @ B, 1 - 9                                     |
| 13. Rear Openings                                  | N/A   |
| 14. Operation                                      | Automatic Duplex Collective Operation / New             |
| 15. Control  | New Closed Loop, Variable Voltage Variable Frequency AC |
| 16. Fireman's Service                              | New, as specified                                       |
| 17. Machine Room, Secondary, Pit Lighting and GFCI | As indicated on plans                                   |
| 18. Machine Type                                   | New Permanent Magnet AC Gearless Machines               |

19. Power Drive	New Solid State VVVF - Regenerative
20. Machine Location	Above
21. Governor tail sheave	New
22. Platform, Safety Plank	Retain Platform and Safeties
23. Counterweight	Retain Existing
24. Guide Rails	Retain Existing
25. Guides	Car and Counterweight / New
26. Buffers	New
27. Car Door Size / Type	New / 4'-0" x 7'-0" /Two Speed Side Slide
28. Hoistway Door Size / Type	Retain - Size same as Car Door Size
29. Master Door Operator(s)	New
30. Car Entrance Sills	New - Nickel Silver
31. Tracks, Hangers	New
32. Interlocks, Closers	New
33. Hoistway Doors	New door panels, retain entrance assembly
34. Top Emergency Exit	New with new cab
35. Power Supply	Retain / Modify as required for 208VAC
36. Wiring and Traveling Cables	New
37. Card Reader	New
38. Number of Push Button Risers	Two (2)
39. Hall Operating Fixtures	New
40. Car Operating Fixtures	New
41. Communication	New
42. Door Protective Device	New
43. Emergency Cab Lighting	New
44. Car Ventilation	New
45. Car Enclosure	New Shell and Cab complete
46. Car Doors	New
47. Car Flooring	New / New aluminum diamond plate
48. Car Sill	New / Nickel Silver
49. Car position indicator	New
50. Lobby Panel	New
51. Elevator Monitoring System	New

C. Passenger Elevators No. 7 - No. 9 (B Bank)

1. Quantity	Three (3) / Retain
2. Type	Passenger / Retain
3. Capacity (lbs.)	4,000 / Retain
4. Speed (fpm)	500 / Retain
5. Travel in Feet	Field Verify
6. Roping/Ropes	2:1

Replace Mechanical Controls  
 Upgrade Cabs Main Elevators  
 Project No 657-15-200JC  
 02-17bp

7.	Hoisting	New
8.	Governor	New
9.	Compensation	New
10.	Number of Landings	Nine (9) @ B, 1 - 8
11.	Number of Openings	Nine (9) @ B, 1 - 8
12.	Front Openings	Cars 8 and 9: Nine (9) @ B, 1 - 8 Car 7 only: Three (3) @ 3, 7,8
13.	Rear Openings	Car 7 only: Six (6) BR, 1R, 2R 4R, 5R, 6R, (Car 8 and 9 new at 2 <sup>nd</sup> floor).
14.	Operation	Automatic Group Collective Operation / New
15.	Control	New Closed Loop, Variable Voltage Variable Frequency AC (VVVF)
16.	Fireman's Service	New, as specified
17.	Machine Room, Secondary, Pit Lighting and GFCI	Provide New as indicated on plans
18.	Machine Type	New Permanent Magnet AC Gearless Machines
19.	Power Drive	New Solid State VVVF - Regenerative
20.	Machine Location	Above
21.	Governor tail sheave	New
22.	Platform, Safety Plank	Retain Platform and Safeties
23.	Counterweight	Retain Existing
24.	Guide Rails	Retain Existing
25.	Guides	Car and Counterweight / New
26.	Buffers	New
27.	Car Door Size / Type	New 4'-0" x 7'-0" / Two Speed Side Slide
28.	Hoistway Door Size / Type	Same as Car Door Size
29.	Master Door Operator(s)	New
30.	Entrance Sills	Retain Existing/Recondition
31.	Tracks, Hangers	New Except car 7 at 7 <sup>th</sup> floor front. Retain all and bolt shut to prevent accidental operation
32.	Interlocks, Closers	New
33.	Hoistway Entrances	New - 2 <sup>nd</sup> floor rear cars 8 & 9
34.	Hoistway Doors	New door panels, retain entrance assembly
35.	Top Emergency Exit	New with new cab
36.	Power Supply	Retain / Modify as required for 480 VAC

37.	Wiring and Traveling Cables	New
38.	Card Reader	New
39.	Number of Push Button Risers	Two (2)
40.	Hall Operating Fixtures	New
41.	Car Operating Fixtures	New
42.	Communication	New
43.	Door Protective Device	New
44.	Emergency Cab Lighting	New
45.	Car Ventilation	New
46.	Car Enclosure	New Shell and Cab complete
47.	Car Doors	New
48.	Car Flooring	New / Flexible Terrazzo Tile
49.	Car Sill	New / Nickel Silver
50.	Car Position Indicator	New
51.	Lobby Panel	New
52.	Elevator Monitoring System	New / All groups

## 2.2 MANUFACTURERS

### A. Pre-Approved Equipment Manufacturers

1. The following manufacturers' equipment and materials have been pre-approved for use on this project.
2. Other equipment not specifically mentioned shall be considered for approval on an individual basis.
3. Certain Original Equipment Manufacturers equipment is acceptable unless otherwise specified.
  - a. Controller - GAL (GALaxy), Motion Control Engineering (I-Control), Elevator Controls Corporation, Elevator Systems, Inc.
  - b. Tracks, Hangers, Interlocks and Door Operators - G.A.L.
  - c. Fixtures - G.A.L., Adams, EPCO, Monitor, E-Motive USA, C.E. Electronics, Innovation, PTL, MAD, National.
  - d. Door Protective Device - Janus, Adams, G.A.L., T.L. Jones, Tri-Tronics.
  - e. Cabs and Entrances/Entrance Door Panels - Accurate Elevator Door Corp, EDI/ECI, National Cab & Door, Tyler, Velis, Gunderlin, Premier, Prestige, Regency.
  - f. Machines - Hollister-Whitney, Titan, Imperial, Torin (specific models to be approved upon submission).
  - g. Motors - Imperial Electric, General Electric, Baldor, Reuland Electric.
  - h. VVVF Power Drives - Mitsubishi, MagneTek, Yaskawa, TorqMax.(Magnetek or approved equal)

- i. VVVF Emergency Power Systems - MCE, Reynolds & Reynolds Electronics.
- j. Guide Rails - AFD Industries, Saveria, Monteferro.
- k. Electrical Traveling Cables - Draka, James Monroe
- l. Governor: Hollister Whitney, MCE, approved equal
- m. Buffers: Hollister Whitney, MCE, approved equal
- n. Hydraulic Systems/Components - Canton, ECS Corporation, Elevator Equipment Corporation, Mongrain Vertical Transport (MVT), MEI, Schumacher.
- o. Freight Doors and Systems - Courion, EMS Group, Peelle, Matot.
- p. Guide Shoes/Rollers - ELSCO, G.A.L.
- q. Wire Ropes - Paulsen, Bethlehem, Wayland, Draka, Brugg.
- r. Intercommunications/Telephones - Webb Electronics, K-Tec, Ring, Wurtec, Janus, EMS approved equal.
- s. Cab Vendors: G&R, H&B, approved equal.

## 2.3 CONTROL FEATURES / OPERATION

### A. Control Equipment (All Elevators)

- 1. Provide a new non-proprietary microprocessor-based elevator control system.
- 2. The controller vendor shall be able to provide immediate 24/7 tech support.
- 3. Controller parts shall be available for overnight delivery mail, including any parts necessary for maintenance.
- 4. Digital logic shall calculate optimum acceleration, deceleration and velocity patterns for the car to follow during each run.
- 5. Closed-loop distance and velocity feedback shall monitor the actual performance of the elevator car with the desired speed profile.
- 6. System operating software shall be stored in non-volatile, electrically programmable read only memory (EPROM), electrically erasable and programmable read only memory (EEPROM), or flash read only memory (flash ROM).
  - a. Elevator control relays, contactors, switches, capacitors, resistors, fuses, circuit breakers, overload relays, power supplies, circuit boards, static motor drive units, wiring terminal blocks and related components shall be totally enclosed inside a free-standing metal cabinet with hinged access doors.
  - b. Mechanical ventilation of the cabinet shall be provided and shall be adequate to dispose of the full load heat losses without exceeding 40° C (104° F) ambient temperature.

- c. All electrical wiring inside the control equipment cabinet shall be performed in a neat manner with field wiring terminated at stud blocks provided inside the control cabinet.
- d. Each wiring terminal shall be clearly identified according to the nomenclature used on the "as built" wiring diagrams. No more than two (2) field wires may be connected to any single terminal stud.
- e. Spare wires shall be tagged according to their point of termination, bundled, and placed at the bottom of the control equipment cabinet.
- f. Each electrical component within the cabinet shall be permanently identified with symbols, identical to those used on the "as-built" wiring diagrams.
- g. A data plate that indicates the edition of the Code in effect at the time of installation and/or alteration shall be provided in accordance with applicable code and requirements of ASME A17.1 Code. The data plate shall be in plain view and securely attached on the mainline disconnect or on the controller.
- h. Control equipment shall comply with requirements of all applicable Sections of the ASME A17.1 Code as approved and adopted by the AHJ.
- i. A 17" flat-panel LCD monitor shall be provided inside the elevator machine room for diagnostic purposes. The monitor shall be permanently mounted in a cabinet, or in a control cabinet of at least one car of a group. By means of graphic depiction, information available on the screen shall include:
  - 1) An overview of car and corridor calls currently existing within the system.
  - 2) Elevator operating status.
  - 3) Elevator position, direction of travel and velocity.
  - 4) The open/close status of elevator door.
  - 5) The current operational status of each CPU input and output.
  - 6) A sequential history of faults detected within the control system over the previous thirty (30) days.
- j. Provide a microprocessor-based computer system and keyboard in the machine room that allows technicians to place car and hall calls, adjust car/group system parameters, adjust door system parameters, dispatch timers, and other adjustable features that work in conjunction with the aforementioned monitor.

B. Cross Registration (Elevators No. 1 - No 4 and No. 7 - No. 9)

1. In conjunction with the installation of the first new controller, the new dispatcher shall be installed and interfaced with the existing dispatcher to allow controlled cross registration of hall calls within each group of elevators (new and old).
    - a. The existing temporary apparatus that is retained shall undergo a complete preventive maintenance restoration to ensure new dispatching controls increase efficiency and reduce waiting times with improved reliability and performance during the primary work period.
  2. Registered hall calls shall be immediately registered in the new dispatcher and assigned to the modernized elevator(s) for response.
    - a. The new dispatcher shall continuously calculate the ETA (Estimated Time of Arrival) of the modernized elevator(s) response to the registered calls.
    - b. Should the calculated ETA exceed the pre-determined time limit, (field adjustable from 0 to 199 seconds), the registered calls with excessive wait times shall be transferred from the new dispatcher to the original dispatcher for assignment to the existing elevator(s).
  3. Initial long-wait timer values shall be adjusted at a low setting when less than 33% of the total group is modernized and shall be increased as additional modernized elevators are added to the group.
  4. Timer values shall be manipulated to achieve the best group performance based on the ration of both modernized and existing elevators.
- C. Automatic Group Duplex / Selective Collective Operation (Service Elevators 5&6)
1. Provide duplex selective collective operation with the two cars arranged to operate from dual risers (located as noted on the drawings) of hall push buttons.
  2. When there is no demand for elevator service, park one car at the Lobby Floor and the other shall be a "free car", parking at the floor last served.
    - a. Park both cars with doors closed.
    - b. The "free car" shall normally respond to any registered hall call except:
      - 1) A hall call registered at the Lobby Floor shall be answered by the car parked at the Lobby Floor.



- 2) A hall call registered below the Lobby Floor shall be answered by the car parked at the Lobby Floor.
3. When the car parked at the Lobby Floor responds to a registered call for a floor above the Lobby Floor, the "free car" shall be dispatched automatically to the Lobby Floor, and shall become the assigned Lobby Floor parking car.
4. When the "free car" is responding to registered calls, the Lobby Floor parking car shall automatically dispatch from the Lobby Floor under any of the following conditions:
  - a. Registration of hall call below the "free car" while it is traveling in the up direction.
  - b. Registration of hall call above the "free car" while it is traveling in the down direction.
  - c. Inability of the "free car" to move in response to a registered hall call within a predetermined time.
5. When both cars are responding to registered car and hall calls, the first car to complete its calls shall become the assigned Lobby Floor parking car and shall be dispatched automatically to the Lobby Floor.
6. If either car is removed from service, the other car shall respond to all registered hall calls and its own car calls.
7. When a car arrives at its last stop and reverses direction of travel, all previously registered car calls shall be automatically cancelled.
8. When a car has responded to the highest or lowest call, and hall calls are registered for the opposite direction, the car shall reverse direction automatically and respond to those registered calls.
9. When a car arrives at a landing where both up and down hall calls are registered, it will answer the call in the direction of travel.
  - a. If no car call is registered, the car shall be assigned to respond to call registered for the opposite direction. The car doors shall immediately close and re-open to respond to the call in the opposite direction.
  - b. Hall lantern operation shall always correspond to direction of service.
10. When an empty car reverses direction at a landing with no hall calls, the doors shall not open and the hall lantern shall not operate.
11. If a car has no car calls registered and arrives at a floor where both up and down hall calls have been registered, the

- car shall respond to the hall call corresponding to the direction of car travel.
12. If, after making its stop, a car call is not registered and no other hall calls exist ahead of the car corresponding to its original direction of travel, the doors shall close and immediately reopen in response to the hall call for the opposite direction.
  13. The car shall maintain its original direction at each stop until the doors are fully closed to permit a passenger to register a car call before the car reverses its direction of travel.
  14. In the event that any car is delayed for more than a predetermined time interval after it received a start signal, the system shall automatically permit the remaining car in the two car group to respond to signals and be dispatched in the specified manner.
  15. Coincident calls: The dispatching system shall be designed with a 20 second parameter whereby an elevator with a car call will receive priority to answer a corresponding corridor call if it can do so within 20 seconds. If it cannot answer the call within the prescribed time, the first available car shall be assigned. A continuous reassessment of calls shall be made, with the processor having the capability of reassessing five (5) times per second.
  16. In the event the supervisory control system should malfunction so that neither elevator is assigned calls within a predetermined interval and in accordance with the conditions of the operating strategy in effect, the system shall automatically assume a back-up mode of operation whereby the elevators shall be arranged to provide continuous service to each landing in a predetermined pattern without regard to actual corridor call demands.
- D. Automatic Group Operation / Conventional Dispatch [Elevators 1-4 (A Bank) & 7-9 (B Bank)]
1. A microprocessor-based group supervisory control system with the following features shall control the operation of the elevators:
    - a. Redundant (distributed) dispatching.
    - b. Artificial Intelligence.
    - c. Advanced software diagnostics.
  2. Elevators shall be arranged to operate with or without attendants as an automatic group.

- a. The group shall remain capable of sustaining balanced service and continuing operation with one or more cars removed from the system.
  - b. Elevators shall operate from pushbutton panels located inside each car and from a riser(s) of corridor pushbutton fixtures located on each landing served.
3. Elevators shall automatically travel to landings for which a call demand exists.
- a. Stops in response to calls that are registered at either the car or corridor push button stations shall occur in the natural order of progression in which the floors are encountered, depending on the direction of car travel, and irrespective of the order in which calls are registered.
4. Call acknowledgment lights (ultra-bright white LEDs) provided in both the car and corridor push button fixtures shall become extinguished as the car responding to a particular call begins its slowdown approach to the corresponding landing.
5. In the event no demand for elevator service exists, the first car to satisfy its assigned calls shall be dispatched to park at the main landing.
- a. In the event additional cars should also complete their call assignments, those cars shall be individually dispatched to previously designated parking floors.
  - b. Parking assignments shall be accomplished without door operation.
  - c. Should the elevator parked at the main landing receive a call assignment, another free car in the group shall immediately assume that parking assignment.
  - d. The number of elevators assigned to park at any particular landing shall be programmable.
6. The group supervisory controller shall, through a dispatching algorithm along with artificial intelligence parameters, continuously scan the system in order to determine the load each car is transporting and to monitor the number of corridor calls registered, the duration of each call, and the intended direction of travel, the number of loaded lifts, etc.
- a. Based upon that data, the supervisory system shall automatically devise a strategy for call assignment with preference given to calls registered in the following order:

- 1) Lobby demand
  - 2) Long waiting times - down
  - 3) Long waiting times - up
  - 4) Up calls
- b. Long wait calls shall be considered those which have remained unanswered for at least forty (40) seconds. The long wait call threshold time shall be programmable.
7. If a car with no car calls arrives at a landing where both up and down hall calls are registered, it will answer the call in the direction of travel.
- a. If no car call is registered, the car shall be assigned to respond to the call registered for opposite direction.
  - b. The doors shall close and immediately re-open when responding to this call.
  - c. Hall lantern operation shall always correspond to direction of service.
8. In the event that any car is delayed for more than a predetermined time interval after it received a start signal, the system shall automatically permit the remaining cars in the group to respond to signals and be dispatched in the specified manner.
9. In the event the group dispatching or supervisory system should malfunction so that elevators are not assigned to calls within a predetermined interval and in accordance with the conditions of the operating strategy in effect, the system shall automatically assume a back-up mode of operation whereby the elevators shall be arranged to provide continuous service to each landing in a predetermined pattern without regard to actual corridor demand.
- a. Failure of the automatic dispatching system will be indicated by an illuminated signal in the Lobby Elevator Control Panel where applicable.
10. In the event of failure of the landing call button circuit, provide a means to enable the elevators to service each floor without registration of a call within the elevators.
- a. Provide an illuminated signal in the lobby Elevator Control Panel to indicate that this emergency operation is in effect.

11. When a car arrives at its last stop and reverses direction of travel, all previously registered car calls shall be automatically cancelled.
12. When a car has responded to the highest or lowest call, and hall calls are registered for the opposite direction, the car shall reverse direction automatically and respond to those registered calls.
13. When an empty car reverses direction at a landing with no hall calls, doors shall not open and the hall lantern shall not operate.
14. Main Lobby Operation:
  - a. Only the "Next" designated car shall have its hall lantern illuminated and its doors open.
  - b. When a "down" traveling car which is not designated "Next" arrives at the main lobby with a lobby car call registered, it will open its door to discharge the passengers but shall not illuminate its lantern.
    - 1) The doors shall close one (1) second after the door protection is re-established.
  - c. When a "down" traveling car with no car calls arrives at the main lobby and is not designated "Next", it shall park without opening its doors.
15. Coincident Calls:
  - a. The dispatching system shall be designed with a 20 second parameter whereby an elevator with a car call will receive priority to answer a corresponding corridor call if it can do so within 20 seconds.
  - b. If the elevator cannot answer the call within the prescribed time, the first available car shall be assigned.
  - c. A continuous reassessment of calls shall be made.
16. Full Selective Operation
  - a. Elevators having front and rear entrances at the same floor shall be arraigned such that only the selected door (front or rear) shall open when arriving at that floor.
17. Separate Riser Operation - Car #7
  - a. A separate riser of hall buttons shall be provided at all floors. Served by car #7 in B Bank.

- b. When an up or down call is entered into any of these buttons the calls shall be assigned to car 7 only and response shall be as noted above.

E. Motion Control (New - All Elevators)

1. Smooth stepless acceleration and deceleration of the elevator car shall be provided in either direction of travel during both single or multiple floor runs.
2. Use digital logic to calculate optimum acceleration and deceleration patterns during each run.
  - a. The amplitude of acceleration and deceleration shall not exceed 4 ft/sec<sup>2</sup>.
  - b. The maximum jerk rate shall not exceed 8 ft/sec<sup>3</sup>.
  - c. The maximum jerk rate shall be 1.5 to 2.0 times the acceleration and deceleration.
  - d. The maximum velocity which the elevator achieves in either direction of travel while operating under load conditions that vary between empty car and full rated load shall be within  $\pm 2\%$  of the rated speed.
  - e. Elevator control system shall be capable of starting the car without noticeable "rollback" of hoisting machine sheave, regardless of load condition in car, location of car, or direction of travel.
3. Floor leveling accuracy of  $\pm 1/4"$  as measured between the car entrance threshold and the landing sill on any given floor shall be provided.
  - a. This accuracy standard shall be maintained under varying load conditions and without need for releveling corrections caused by overshooting or stopping short of the floor.
4. Elapsed flight time during a typical elevator one floor run shall not exceed values as further specified.
  - a. Timing, as measured between the moment door closing operations begin and when the doors are 3/4 open at the next adjacent floor, shall remain consistent under varying load conditions in either direction of travel.

F. Independent Service Operation (All Elevators - New)

1. The car operating station shall be equipped with a key-operated switch labeled "IND SER".
2. Location of the switch to be determined by owner
3. When placed in the "on" position the following shall occur:

- a. Group elevator - the elevator shall bypass corridor calls and travel directly to any floor chosen by registration of a car call. Hall calls shall remain registered for service by another elevator in the group.
  - b. Simplex elevator - existing hall call registrations shall extinguish and hall buttons shall remain inoperative as an indication to passengers that there is no elevator service.
4. During Independent Service Operation, the elevator doors shall remain open at any landing until the door close or car call registration pushbutton, is pressed and maintained until the doors are fully closed.
  5. If more than one (1) car call is registered, all registered car calls shall extinguish when the elevator stops in response to the first call.
  6. In case an elevator is operating on the Independent Service mode and the Fire Emergency Recall system becomes activated, the elevator shall automatically override Independent Service Operation and engage Phase I - Fire Emergency Recall Operation following a period of approximately forty-five (45) seconds.
- G. Inspection Service Operation (All Elevators - New)
1. Provide a key operated switch in the main car operating panel that, when turned to the 'ON' position, shall cause the elevator to be removed from service and placed in Inspection Service Operation.
  2. The car shall move at a speed not to exceed 150 feet per minute (0.75 meters per second) as per code with both the hall and car door panels in the closed and locked position.
  3. The Inspection Service switch shall be keyed differently than other typical keys used in the operation of the elevator. Keying shall be in accordance with Security Group Classifications as required by applicable code.
  4. The top of the elevator car shall be equipped with a control for limited operation of the car during repairs, maintenance and inspection conducted in the hoistway. The transfer of control to the top of car operating device shall cause that device to be the sole means of control for the elevator.
  5. Power door operating equipment shall be rendered inoperative while the car is being operated in the Inspection Service mode with the exception of power closing of the door. The control system shall maintain closing power on the door while the elevator is moving under Inspection Service Operation.

6. The in-car Inspection Service switch shall be rendered ineffective when the top of car inspection control is activated.
7. Machine Room Inspection Operation and Inspection Operation with open door circuits shall be provided in accordance with A17.1 Safety Code where required or allowed by the AHJ.

H. Hoistway Access Operation (All Elevators - New)

1. Provisions shall be made to allow access to the hoistway through the use of hoistway access switches.
2. Operating the access switch shall permit the car to move at a speed not to exceed 150 feet per minute (0.75 meters per second) as per code with the hall and car doors in the open position to obtain access to the top of the car.
3. The car shall automatically stop motion when the car top is level with the hoistway door sill.
4. The access key switches shall be keyed differently than other typical keys used in the operation of the elevator. Keying shall be in accordance with Security Group Classifications as required by applicable code.
5. Access operation shall be disabled when top of car inspection operation is in effect.

I. Load Weighing Operation (All Elevators- New)

1. A positive means shall be provided to continuously monitor the amount of load being transported by the elevator car.
2. The system shall be used to;
  - a. Preload static motor drives
  - b. Activate control features that include:
    - 1) Overload/ Full Car warning
    - 2) Anti-nuisance operation
    - 3) Load dispatch operation
    - 4) Load dependent non-stop operation where applicable.
3. The anti-nuisance feature shall operate at loads not exceeding 200 lbs., whereas load dispatch and load non-stop shall be set to function at 65% of the rated loading capacity for the initial set up and adjustment procedure.

J. Anti-Nuisance Operation (All Elevators - New)

1. In the event car loading or operation is not commensurate with the number of car calls registered, all car calls shall be canceled.



- a. The system shall monitor the door protection device to determine if passenger transfer exists.
- b. If after the third stop a passenger transfer has not occurred, the system shall cancel all remaining car call registrations and resume normal operation by responding to assigned hall call demand.
- c. The number of calls registered with no passenger transfer that will trigger anti-nuisance shall be adjustable. Initially set this threshold to 3 calls.

K. Fire Emergency Operation (All Elevators - New)

1. Firefighters Service Operation and devices shall meet applicable code requirements of the AHJ.
2. Contractor shall be responsible for compliance in all aspects of Firefighters Service including, but not limited to the mode of operation, initiation of operation, operating /control and signaling devices as well as fixture engraving including operating instructions applicable to and where required by the specific Jurisdiction.
3. Phase I - Emergency Recall Operation shall be provided for each car in accordance with ASME A17.1 code as modified under the applicable local or State law.
4. Each main or auxiliary car operating station shall be provided with an indicator light and warning buzzer, each of which shall become activated whenever Phase I Operation is engaged. The warning buzzer shall cease to function once the car has completed the recall sequence and is positioned at the designated recall landing. The indicator light shall remain illuminated as long as Phase I Operation is activated.
5. A three-position, key-operated switch shall be provided on the designated recall landing to manually activate Phase I Operation. When activated, Phase I Operation shall be arranged so that in order to reset normal service, all cars must first be returned to the designated recall landing, after which the Phase I key-switch must be turned to the "OFF" position.
6. Phase II - Emergency Recall In-Car Operation shall be provided for each car in accordance ASME A17.1 code as modified under local or State law.
7. Each main or auxiliary car operating station shall be equipped with a three-position, key-operated switch to engage Phase II Operation on elevators which have completed the Phase I recall sequence and which are parked at the designated recall landing or alternate floor landing. Subsequent to activating Phase II Operation on any elevator, that elevator must be returned to the designated recall landing in order to discontinue that service mode.

8. Each main or auxiliary car operating station shall be provided with a "CALL CANCEL" push button that functions only under Phase II operating mode. When activated, pressing the "CALL CANCEL" button shall cause any previously registered car calls to cancel per ASME standards.
9. Each main or auxiliary car operating station shall incorporate the National Standard fire logo and/or operating instructions, engraved and red color filled, as required by the applicable local or State law requirements.
10. Contractor shall be responsible for compliance in all aspects of Firefighters Service including, but not limited to the mode of operation, initiation of operation, operating/control and signaling devices, including fire command panels, as well as fixture engraving, including operating instructions applicable to and where required by the specific Jurisdiction.
11. All Fire Service key switches shall be keyed to FEO-K1 national standard.

L. Emergency Power Operation

1. Existing provisions shall be duplicated and upgraded for automatic sequential operation.
2. Provisions shall be included in the new elevator control system whereby, immediately after transferring to the building emergency power system, all affected elevators shall automatically return the main fire recall landing in progressive numerical sequence at normal operating speed.
  - a. Car and corridor calls shall become inoperative and all previously registered calls shall be canceled.
  - b. As each car arrives at the designated landing, it shall park out of service with its door in the open position.
3. An illuminated signal marked "ELEVATOR EMERGENCY POWER" shall be provided in the elevator lobby at the designated level to indicate that the normal power supply has failed and the emergency power is in effect.
4. In the event an elevator fails to respond to a recall command within forty-five (45) seconds under Emergency Power Operation, that car shall be bypassed and the next car in the sequence shall be recalled.
5. Upon completion of the recall process, one or more elevators shall be automatically selected to run on the emergency power source (duty car(s)).
6. Interlock all elevators to allow to operate the maximum number of elevators at a time.

7. An emergency power control panel shall be provided where indicated by the Owner containing an indicator light per elevator that becomes illuminated whenever a transfer to emergency power takes place.
    - a. Provide a key-operated override switch and a manual selector switch with a position indicator for each elevator.
    - b. Activating the key-operated override switch while on emergency power shall cancel the automatic recall sequence and allow positioning of the manual selector switch to select a car for operation.
  8. Means shall be provided adjacent to the control panel to indicate that the elevator is at the designated level with the doors in the open position.
  9. Testing of elevators under emergency power shall be accomplished with the building ATS providing a "pre-test" signal to the elevator control apparatus.
    - a. The pre-test signal shall initiate the landing of the elevators prior to the transfer from normal to emergency power.
    - b. After testing, the building ATS shall provide a "pre-transfer" signal to land the elevators prior to the transfer from emergency to normal power.
- M. Floor Lockout Feature / Keyless - Card Reader Security System / Car and Hall (New)
1. Card Reader Control of Selected Elevators
    - a. All elevators shall be card reader controlled by the security system and or modified for future card reader capabilities, including hardware and software in the elevator controllers and car operating panels.
    - b. Control shall be on an individual floor programmable basis allowing the user to access only those floors for which their access card is programmed.
      - 1) The ground floor shall always be available without the need of an access card.
    - c. The security system shall provide for control of the elevator on a time programmable basis allowing access to certain floors/doors via card reader while allowing free access to other floors/doors at the same time.
    - d. When an elevator is in the card reader control mode of operation, the elevator user shall be required to hold their access card up to a card reader mounted on the

elevator return panel and push the desired floor/door select button, even while in non-automatic modes of operation.

- 1) The elevator control system shall light the selected button from the time of authorized floor/door selection until the elevator reaches the selected floor.
- e. To place the elevator in the card reader controlled mode of operation, a maintained contact closure (provide by the security system) shall be established across a pair of elevator controller terminals (provided by the Elevator Contractor).
  - f. To provide for card reader control of elevators, the application of a dry contact open and/or closed (provided by the security system) across a pair of terminals per floor or door per elevator (provided by the Elevator Contractor) shall enable the selection of the authorized floor/door select buttons in the elevator.
    - 1) When the elevator is in the card reader controlled mode, the contacts provided by the security system shall be open and shall close for five seconds upon reading a valid card to allow the floor to be selected and the call for that floor registered.
    - 2) When the elevator is in the non-reader controlled mode, the contacts shall be closed, allowing the floor to be selected without a card reader.
  - g. When the hall call button is in the card reader controlled mode of operation, the elevator user shall be required to hold an access card up to a card reader mounted adjacent to the hall call station to enable activation of the hall call button.
    - 1) The acknowledging light shall illuminate the time of authorized activating until the elevator arrives.
  - h. The security system shall provide for card reader control of the elevator hall call button on a time programmable basis.
  - i. To provide for card reader control of the elevator hall call button, provide a pair of terminals such that the application of a dry contact closure across those terminals by the security system shall enable the activation of the hall call button.

- j. When the hall call station is in the card reader controlled mode, the security system shall place a closure across the contacts for five seconds upon reading a valid card to allow for activation of the button.
  - k. When the hall call station is in the non-reader controlled mode, the security system shall maintain a closure across the contacts allowing the hall call button to be selected without an access card.
  - 2. Design and interface security control with primary control signaling for fire or other emergency control override features per local law.
- N. Floor Lockout Feature / Keyless - Card Reader Control / Wiring Provisions
- 1. Wiring: Provide six (6) pair of 20 gauge two (2) flexible conductor low voltage cables with an overall braided shield in the traveling cable of all elevators for card reader interface.
    - a. The cables shall extend from the security interface terminal cabinet in the elevator machine room to behind the elevator return panel above the space allotted for the card reader.
    - b. Terminate the cable to dual screw barrier terminal strips on each end.
  - 2. Card Reader Space: Allocate card reader space in each main car station as directed by the Owner. A removable flush mount face plate shall be integrated in the main car operating panel, with final design as approved by the owner. Any required mounting provisions will be included in the panel for existing and future applications.
  - 3. Interface: For floor programmable card access control in all elevators, provide a pair of terminals for all floors such that application of a momentary dry (no voltage present) contact closure across those terminals by the security system shall enable the selection of the corresponding floor from the floor selector button in the elevator cab.
    - a. Locate the terminals inside an interface terminal cabinet in the elevator machine room.
    - b. Provide all relays required to interface the elevator control system to the momentary dry contact closures provided for under another section of these specifications.

- c. If applicable, the card reader shall be operable and compatible with the issued card keys used building wide.
  - d. Coordinate system requirements with the manufacturer of the issued card key system.
4. Card Reader "Secure/Bypass" Switch: Provide separate card reader control bypass key switches for each elevator.
- a. The bypass key switches shall be located in the Director's Control Panel.
  - b. The bypass key switches shall be a maintained contact type key switch with the key removable in the secure or bypass position.
    - 1) When the key switch is in the secure position, the card reader control mode shall be initiated.
    - 2) When in the bypass position, the card reader control mode shall be bypassed and the elevator shall return to normal operation, permitting free access to any floor.
5. The card reader operation shall bypass floor cut-out switches.
6. Firefighter controls shall override all security operations.
7. Monitoring of Elevator Duress Alarm Buttons.
- a. The security system shall provide auxiliary monitoring of the duress alarm buttons in each elevator.
  - b. Activation of an elevator duress alarm button shall cause an alarm indication on the security system operator's terminal.
  - c. To provide for monitoring of the elevator duress alarm button, provide a pair of terminals per elevator such that when the duress button is activated, a normally closed dry contact across those terminals shall open and remain open for as long as the duress button is activated.
0. CCTV Camera Surveillance of Elevators
- 1. A camera shall be installed in each elevator cab with a location to be determined by the VA, to provide for camera surveillance of all passenger elevators.
  - 2. Include labor and coordination to install all equipment in the new cabs. Wiring will be installed in an easily accessible junction box on the car top.

3. The wiring for the cameras shall extend from the security interface terminal cabinet in the elevator machine room to the top of the elevator, in an electrical box which is easily accessible.

P. Firemen's Override

1. Firemen's override and automatic recall functions shall bypass all security elevator control functions.

Q. System Interface

1. Provide a terminal cabinet in each elevator machine room for elevator / security system interface. The terminal cabinet shall contain all terminals required to interface the elevators located in the machine room to the security system.

R. Submittals

1. Submit product specifications, fabrication shop drawings, and wiring diagrams of the following:
  - a. Elevator / Security interface terminal cabinet
  - b. Card reader installation
  - c. CCTV camera installation
  - d. Key switch installation
  - e. Traveling Cables

S. Interface Terminal Cabinet

1. The interface terminal cabinet shall be a lockable continuous hinge cover NEMA Type 1 enclosure.
2. The cover of the enclosure shall be labeled to identify its function.
3. Dual screw barrier type terminal strips shall be provided within the interface terminal cabinet.
  - a. Terminals shall be provided for each interface point.
  - b. All terminals shall be labeled to identify their function.

T. Traveling Cable

1. The card reader interface traveling cable shall be one (1), twelve (12) conductor 20 gauge stranded, low voltage cable with an overall braided shield and drain wire.
2. The CCTV camera interface traveling cable shall be two (2), RG-59U stranded center conductor coax cables and one (1),

two (2) conductor 20 gauge stranded, low voltage cable with an overall braided shield and drain wire.

3. One (1) RG-6 Ethernet
4. All security interface traveling cables shall be located in the elevator control traveling cable and shall be isolated from other traveling cables used to carry high voltage alternating current circuits.

U. Bypass Key Switch

1. The bypass key switch shall be a maintained contact type key switch with the key removable in either the bypass or normal position. All bypass key switches shall be keyed alike.
2. Each bypass key switch shall be labeled to identify its function, the secure position, and the bypass position.

V. Interface Terminal Cabinet Installation

1. Install the interface terminal cabinet within the elevator machine room in a readily accessible location no more than 6'-0" AFF.
2. Provide any control logic and relays that will be required to interface the elevator control system to the dry contact closures (rated for 1 AMP at 24 VDC) provided by the security system.
3. Provide interconnect wiring from the elevator control system to the interface terminal cabinet.
4. The security contractor shall wire from the security system to the interface terminal cabinet.

W. Card Reader and CCTV Camera Installation

1. The card reader and CCTV camera shall be provided by the security contractor and installed by the Elevator Contractor.
  - a. The security contractor shall provide supervision, wiring details and installation diagrams to the Elevator Contractor.
  - b. The exact card reader and CCTV camera locations shall be specified by the Owner.

X. Traveling Cable Installation

1. Traveling cables for card reader interface shall extend from the elevator / security interface terminal cabinet in the elevator machine room to behind the elevator return panel.



2. Terminate the cables including the drain wire to dual screw barrier terminal strips in the interface cabinet and provide 6 feet of excess cable behind the elevator return panel.
3. The Elevator Contractor shall be responsible for connecting the cable behind the return panel to the card reader under the direct supervision of the security contractor.
4. Traveling cables for the CCTV camera shall extend from the elevator / security interface terminal cabinet in the elevator machine room to the top of the elevator cab and connect to the previously mentioned top of car junction box.

Y. Conduit, Power and Wiring

1. Provide all conduit, power and wiring required for the installation of the terminal cabinet, traveling cables and interfacing to the elevator control system.
2. Provide one (1) 120V duplex unswitched outlet dedicated to security on top of each elevator equipped with CCTV camera.
3. The contractor shall provide all wiring from the interface terminal cabinet to the security system.

Z. Automatic Bypass of Card Reader Control of Elevators

1. The card reader control of elevators shall be automatically bypassed by the security system upon a fire alarm condition.
2. To provide for automatic bypass, the fire alarm contractor shall provide a normally closed dry output contact from the fire alarm system.
  - a. Upon a fire alarm condition, the contact shall open the elevator system shall bypass the card reader control of elevators.
  - b. The contact shall remain open until the fire alarm system is manually reset.

AA. System Interface

1. To provide for interfacing the dry contact output from the fire alarm system to the elevator system. The fire alarm contractor shall provide an interface to the elevator system for card reader controlled Elevators.

BB. Hospital Emergency Service Operation /Code Blue

1. Activation of any individual corridor card reader shall remove the car from automatic group operation for immediate response to the emergency demand floor.

2. An emergency demand shall cancel or override all registered car calls for this elevator unless the system is functioning under fire emergency control operations, attendant service or independent service.
3. When "Hospital Emergency Service" is activated while this elevator is operating under a special mode as specified above, the "in-car" audible and visible signals shall alert the operator to place the car back in automatic mode for immediate response.
4. Upon arrival at an emergency activated floor, the elevator shall remain parked for an adjustable timed period of one (1) to five (5) minutes or until the "in-car" card reader is activated for emergency service independent operation.
5. The elevator shall remain on emergency independent service until the "in-car" card reader is returned to the normal operating mode.

CC. See "Fixtures" for specific hall station and car operating panel requirements.

DD. Car-to-Lobby Operation

1. Provide a key-operated Car-to-Lobby feature.
  - a. Provide a 3-position key-operated switch for each elevator in the lobby control panel or at a location as directed by the Owner to activate the Car-to-Lobby operating feature.
2. When engaged, this feature shall:
  - a. Cause the affected elevator to return non-stop to the lobby after it has discharged all registered car calls.
  - b. Open the door upon arriving at the lobby for approximately ten (10) seconds, after which the elevator shall park out of service with the door closed.
  - c. Maintain door open button function during the interval in which the car is out of service.
3. Returning the key-operated switch in the lobby panel to the "on" position shall restore the car to normal operation.
4. The Car-to-Lobby operating feature shall be overridden by Phase I - Fire Emergency Operation and inoperative during Phase II - Fire Emergency Operation.

EE. Door Operation

1. Car and hoistway doors shall be arranged to operate in unison without excessive noise or slamming in either direction of travel.

- a. Door opening speeds of two (2) feet per second shall be provided in conjunction with closing speeds of 1.0 feet per second in accordance with governing code.
- b. Door operation shall commence as the car stops level at the floor and the machine brake is applied. Pre-door opening shall not be permitted.
2. Door open and door close time shall be measured between the moment car door operation in either direction begins and the instant at which that cycle is completed.
3. When responding to either a car or corridor call, the amount of time that the elevator door remains stationary in the open position shall be adjustable up to sixty (60) seconds.
  - a. Door open dwell time for a corridor call shall be separate of that for a car call, and in both cases, dwell time shall be canceled whenever the car door protection device is momentarily interrupted by passenger transfers, followed by a reduced door open dwell time of approximately one (1) second (adjustable) after the door protection device is cleared of obstructions.
4. The operation of the door protective device by the interruption of one or more infrared light beams during the close cycle shall cause the immediate reversing of the doors to the full open position.
5. The door closing cycle shall be arranged so that, in the event the door protective devices become continually obstructed after the normal door open dwell time has expired, and following a time interval of approximately thirty (30) seconds (adjustable), a warning tone shall sound and the door closing cycle shall commence at reduced speed and torque per applicable Code requirements.
6. Each car operating station shall be provided with a "door open" and "door close" push button.
  - a. Pressure on the "door open" button shall cause doors in the full open position to remain so and doors engaged in the close cycle to reverse direction and assume the full open position so long as pressure remains applied to the button.
  - b. The "door open" buttons shall also control the open cycle during Phase II - Emergency In-car Operation.
  - c. The "door close" push button shall function on Independent Service, Attendant Service and Phase II - Emergency In-car Operation as well as during normal automatic operations.

7. Each car operating station shall be provided with a "door hold" push button.
    - a. Pressure on the "door hold" button shall cause doors in the full open position to remain in the open position and doors operating in the close cycle to reverse direction and travel to the full open position for an extended (adjustable) period of time to allow for loading and unloading.
    - b. The "door hold" feature shall be overridden when the elevator is on Fire Emergency Phase I and Phase II or when code blue (Hospital service) operation is activated.
    - c. The "door hold" feature shall be cancelled when the "door close" button is pressed.
  8. Repeated attempts by the power door operator to open or close the door at any landing shall be monitored by the control system.
    - a. In the event the door fails to cycle properly after a preset (adjustable) number of attempts, the car shall either travel to the next stop or remove itself from service, depending upon whether the malfunction is in the open or close cycle.
  9. Each hoistway door shall be provided with an automatic self-closing mechanism arranged so that the door shall close and lock if the car should leave the landing while the hoistway door is unlocked.
  10. Car doors shall be arranged to prevent their being manually opened from inside the car unless the elevator is positioned within a floor landing zone.
- FF. Door Operation / Selective (Passenger Elevator 7, 8 and 9, B Bank)
1. Selective door operation shall be provided at floors where both front and rear openings occur.
    - a. Provide a floor button for each opening, clearly identified for front and rear in the car operating panel. A hall call station shall be provided for each hoistway entrance.
    - b. The front doors shall only open in response to a front car call and the rear doors only shall open in response to rear car call.
    - c. The front and rear doors shall open simultaneously in response to a front and rear call registered for the same floor.

- d. The front doors only shall open in response to front hall call and the rear door shall open in response to a rear hall call providing the registered hall call is for the same direction of travel.
  - 1) If the front and rear hall calls are registered at the same floor for the direction of travel, both front and rear doors shall open simultaneously contingent on applicable fire codes of the AHJ.
  - 2) If front and rear hall calls are registered at the same floor for opposite directions, only the front rear doors shall open in response to the registered hall call which corresponds to the direction of travel.
- e. A registered hall call for the direction opposite of the car travel shall not be cancelled and will be answered by the car traveling in the opposite direction.
- f. Front and rear open buttons shall be provided in the car operating panel, the pressing of which shall stop and closing of the corresponding doors and return them to their fully open position.
- g. An elevator responding to Phase I - Emergency Recall Operation shall return non-stop to the designated recall landing and shall only open to the side that has the Firefighter' Emergency Operation controls.

## 2.4 MACHINE ROOM / SECONDARY EQUIPMENT

### A. Control Equipment (All Elevators)

- 1. Provide a new non-proprietary microprocessor-based elevator control system.
- 2. Digital logic shall calculate optimum acceleration, deceleration and velocity patterns for the car to follow during each run.
- 3. Closed-loop distance and velocity feedback shall monitor the actual performance of the elevator car with the desired speed profile.
- 4. System operating software shall be stored in non-volatile memory.
  - a. Elevator control relays, contactors, switches, capacitors, resistors, fuses, circuit breakers, overload relays, power supplies, circuit boards, static motor drive units, wiring terminal blocks and related components shall be totally enclosed inside a free-standing metal cabinet with hinged access doors.

- b. Mechanical ventilation or air conditioning of the cabinet shall be provided and shall be adequate to dispose of the full load heat losses without exceeding 40° C (104° F) ambient temperature.
  - 1) Where integral air conditioners are not employed, control equipment cabinets shall be provided with forced air ventilation to prevent overheating of the electrical components housed therein.
  - 2) Where integral air conditioners are employed, control equipment cabinets shall be "NEMA 12" rated with no ventilation fans or slots.
- c. All electrical wiring inside the control equipment cabinet shall be performed in a neat manner with field wiring terminated at stud blocks provided inside the control cabinet.
- d. Each wiring terminal shall be clearly identified according to the nomenclature used on the "as built" wiring diagrams. No more than two (2) field wires may be connected to any single terminal stud.
- e. Spare wires shall be tagged according to their point of termination, bundled, and placed at the bottom of the control equipment cabinet.
- f. Each electrical component within the cabinet shall be permanently identified with symbols, identical to those used on the "as-built" wiring diagrams.
- g. A data plate that indicates the edition of the Code in effect at the time of installation and/or alteration shall be provided in accordance with applicable code and requirements of ASME A17.1 Code. The data plate shall be in plain view and securely attached on the mainline disconnect or on the controller.
- h. Control equipment shall comply with requirements of all applicable Sections of the ASME A17.1 Code as approved and adopted by the AHJ.
- i. A 17" flat-panel LCD monitor shall be provided inside the elevator machine room for diagnostic purposes. The monitor shall be permanently mounted in a cabinet, on a shelf immediately adjacent or attached to or in a control cabinet of at least one car of a group. By means of graphic depiction, information available on the screen shall include:
  - 1) An overview of car and corridor calls currently existing within the system.
  - 2) Elevator operating status.
  - 3) Elevator position, direction of travel and velocity.

- 4) The open/close status of elevator door.
  - 5) The current operational status of each CPU input and output.
  - 6) A sequential history of faults detected within the control system over the previous thirty (30) days.]
  - 7) Password protection of critical programming features is required to prevent accidental changes to life-safety and other non-typical control settings.
  - 8) Where a separate dispatch or group control panel is provided, a separate "LCD" display shall be provided to view group functions.
5. In the event diagnostics and monitoring is accomplished via Field Service Tools, provide the required Field Service Tools with related control system appurtenances for diagnostic evaluations, system monitoring and field adjustments.
- a. Provide instructions for proper use of such diagnostic tools and/or equipment with all coding and other operational requirements.
  - b. Maintain and calibrate the diagnostic tools, and update the associated instructions and other related documents under the service agreement.
    - 1) Should the agreement be cancelled for any reason by either party, maintenance and updating of diagnostic tools shall be provided to the Owner at the Contractor's cost without the need to purchase or lease additional diagnostic devices, special tools or instructions from the original equipment provider.
    - 2) The Owner may request field and technical instructions be provided by the original installation contractor or manufacturer for proper servicing by other qualified elevator company personnel.
    - 3) The established cost plus profit, as previously specified, shall be applicable for the life of the system.
      - a) If the equipment for fault diagnosis is not completely self-contained within the controllers but requires a separate detachable device, that device shall be furnished to the Owner as part of this installation.

- b) Such device shall be in possession of and become property of the Owner.

6. Microprocessor Documentation

- a. Provide and/or obtain complete information on systems' design, component parts, installation and/or modification procedures, adjusting procedures and associated computer conceptual logic circuitry and field connection.
- b. Provide microprocessor upgrading and/or modifications to programs that have been assigned to enhance the operation of the equipment for a period of 10 years after project approval.

B. Machine Beams (Existing)

- 1. Provide additional support beams, angles, plates, bearing plates, blocking steel members, etc., to support new machine, governors, dead end hitches, deflector and overhead sheaves from existing machine beams where applicable.
- 2. Contractor shall verify adequacy of all existing supports scheduled to be reused and report same to the Owner. Any additional machine beams for the new machines will be provided by the elevator contractor.

C. Gearless Elevator Hoisting Machines (New)

- 1. Provide a permanent magnet synchronous motor (PMSM) gearless traction machine, specially designed and manufactured for elevator service. The machine shall have high starting torque and low starting current, rated for 50<sup>0</sup> C (90<sup>0</sup> F) continuous operation, and a minimum of 240 starts per hour.
  - a. The traction driving sheave and brake drum shall be cast integral and bolted securely to the main armature shaft.
  - b. Securely mount the machine frame, including motor fields, bearing stands and brake on a heavy steel bedplate.
  - c. The armature shaft shall be supported in ball or roller type bearings.
  - d. The driving sheave shall be cast from the best grade of metal with a Brinell hardness of 215 to 230 and shall be machined with grooves, providing maximum traction with a minimum of rope and sheave wear.
  - e. Ensure that adequate ventilation of internal stator windings and rotating element is provided to prevent



- overheating with thermal overload protection.  
(Constant velocity fan for constant cooling.)
- f. Equip housing with eyebolt(s) for lifting.
  - g. Provide a spring applied and electrically released electro-mechanical brake.
  - h. Swivel type brake shoes shall be applied to the braking surface simultaneously and with equal pressure by means of helical compression springs.
  - i. Design the brake for quick release to provide smooth and gradual application of the brake shoes.
    - 1) An emergency brake shall be an integral part of the machine design.
  - j. Provide 14-gauge hoist cable guards at the car-drop and counterweight-drop side of the machine sheave.
    - 1) Guards shall cover cables from the point of slab penetration to the point where the hoist cables contact the sheave.
    - 2) Guards shall prevent access to cables at pinch points.
    - 3) Guards shall have no sharp edges.
    - 4) Guards shall be properly mounted to prevent vibration.
  - k. Provide a raised machine arrangement so that the deflector sheave is located above the machine room slab. Provide adequate steel blocking members to support the machine assembly.
    - 1) Provide service platforms, grating, handrails, ladders and required accessories to service and maintain the hoisting machines.
  - l. Where a secondary level exists, span the distance between the car and counterweight with an accurately grooved deflector sheave mounted in the secondary level.
  - m. Provide a sheave guard to prevent hoisting rope from jumping off grooves and to prevent possible entrapment on both sides of the floor penetrations.
  - n. Design and construct the hoisting machine based on passenger elevator cab enclosure weight as specified and as shown on the Architectural drawings.

D. Deflector Sheave (New)

1. Provide overhead and/or hoisting machine wire rope deflector sheave(s) with related apparatus and structural mounting supports.
  - a. Locate and size new sheave to maximize use of available clearances maintaining the present car and counterweight hitch drops.
  - b. New support bearings shall be of a roller type designed for a minimum of twice the total load calculation.
  - c. The sheaves shall be equipped with suitable lubrication devices.
  - d. The deflector sheave shall be provided with means to guard the hoist ropes so they do not jump out of their respective grooves during a slack rope condition.
  - e. Required new mounting beams and structural supports shall be interfaced with existing building structures as may be modified under the terms of this contract for the new design rated loading where applicable.

E. VVVF AC Drive (New)

1. Provide a solid-state, variable voltage, variable frequency (VVVF), 3-phase AC hoist motor drive system as part of the microprocessor-based equipment.
  - a. VVVF drive system shall be a low-noise, flux-vector inverter device.
  - b. Include a digital LED readout and touch-key pad to facilitate software parameter adjustments, monitor system operation and display fault codes.
2. The drive shall utilize a 3-phase, full wave rectifier and capacitor bank to provide direct current power for solid-state inversion.
3. The inverter shall utilize IGBT power semiconductors and duty cycle modulation fundamental frequency of not less than one kilohertz to synthesize 3-phase, variable voltage variable frequency output.
4. The system shall be designed and configured with the following countermeasures for noise generated by the pulse-width modulated (PWM) inverters.
  - a. Control of radiated noise via inverter and/or motor cables.
  - b. Conducted noise through power lines.
  - c. Induction noise and ground noise.
5. Inverter shall be encased in metal and independently grounded.

6. A noise filter for the input power line shall be provided to prevent penetration into radios, wireless equipment and smoke detectors.
7. A 3% three-phase line reactor shall be provided on the power system rated at the utility voltage input to the drive and sized for the rated drive current.
8. Provide interconnection wiring and ground cables in accordance with the manufacturer's design requirements.
9. The drive shall be configured as a complete digital drive system:
  - a. Utilize two (2) microprocessors - one for power conversion circuitry a 16/32 BIT microprocessor controlled PWM.
  - b. Be totally software configurable through high level language.
  - c. Interface with external equipment/signals via either discrete local I/O connections or high speed Local Area Network (LAN).
  - d. Provide fully programmable and adjustable carrier frequency to 16 KHz.
  - e. Be located within the limits of the control cabinet (where system size allows) or separately mounted in an appropriate chassis with hinged swing-out doors with clearances equal to the cabinet width dimensions.
  - f. Provide programmable linear or S-curve acceleration.
  - g. Provide free run or programmable linear or S-curve deceleration.
  - h. Have controlled reversing. Have a minimum of 15 preset speeds>
  - i. Operating and Environmental Conditions:
  - j. Have a service factor of 1.0.
  - k. Rated for continuous duty.
  - l. Humidity - 90% rated humidity non-condensing.
  - m. Altitude - 3300 feet without derate.
  - n. Cooling - forced air when required.
  - o. Digital display for:
    - 1) Running - output frequency, motor RPM, output current, voltage (selectable).
    - 2) Setting - Parameters values for setup and review.
    - 3) Trip - separate message for each trip, last 30 trips to be retained in memory.
10. Protective Features:
  - a. Motor overspeed.
  - b. Adjustable current limit.
  - c. Isolated control circuitry.

- d. Digital display for fault conditions.
- e. Selectable automatic restart at momentary power loss.
- f. Manual restart.
- g. Over/Under Voltage.
- h. Line to line and line to ground faults.
- i. Over-temperature.

F. VVVF AC Drive - Regenerative Module (New)

- 1. The system shall provide full regenerative capabilities to control overhauling motor speed and reduce hoist motor deceleration time by allowing overhaul power to be discharged back into the power lines.
  - a. The regenerative section may be an integral part of the drive or a stand-alone unit.

G. Overspeed Governor (New) - Elevators 7-9 (B Bank)

- 1. Provide a speed governor, located overhead, to operate the car safety.
  - a. Maintain the proper tension in the governor rope with a weighted tension sheave located in the pit.
    - 1) Springs used to develop the tension are not acceptable.
  - b. Provide rope grip jaws, designed to clamp the governor rope to actuate the car safety upon a predetermined overspeed downward. Rope grip jaws directly coupled to the governor mechanism so as to float with governor movement shall not be permitted.
    - 1) The centrifugal type governor shall trip and set rope jaws within 60 degrees of governor sheave rotation after reaching rated tripping speed.
  - c. Design the governor rope tripping device so that no appreciable damage to or deformation of the governor rope shall result from the stopping action of the device in operating the car safety.
  - d. Provide an electrical governor overspeed protective device which shall remove power from the driving machine motor and brake before or at the application of the safety.
    - 1) The setting for the overspeed switch shall be as prescribed in the ASME A17.1 Safety Code.

- 2) Locate and enclose the switch to insure that excess lubrication will not enter the switch enclosure.
  - 3) Overspeed switch shall operate in both direction of travel on systems employing a static power drive unit.
- e. Seal and tag the governor with the running speed, tripping speed and date last tested.
- f. Design the governor to prevent false tripping due to conditions caused by rope dynamics.

H. Overspeed Governor (Reuse) Elevators 1-6 (A Bank)

1. The existing centrifugal overspeed governor shall be refurbished, modified and reused. Governor rope gripping jaws shall be adjusted so that no appreciable rope damage or deformation occurs from the stopping action applied during activation.
  - a. The governor shall be provided with a manually reset electrical safety switch, conforming to ASME A17.1 Safety Code as adopted and/or otherwise amended by the AHJ.
    - 1) When in the tripped position, this switch shall cause all power to be removed from the hoist motor and machine brake.
    - 2) For static power drive applications, this switch shall be designed to operate in both directions of travel.
2. Following the refurbishing and modification work, the overspeed governor shall be tested in accordance with applicable sections of the ASME A17.1 Safety Code as adopted and/or otherwise amended by the AHJ.
3. Seal and tag the governor with the running speed, tripping speed and date last tested.
4. At Contractor's option, a new governor may be substituted and/or provided under the terms of the base Contract.

I. Equipment Isolation

1. Provide sound reducing vibration isolation elements at all support points of elevator controller, solid-state motor drives, isolation transformers, reactance units, hoisting motors and machines.
2. The elements for controllers, solid-state motor drives and isolation transformers shall be similar to double deflection neoprene-in-shear mounts, as manufactured by

Mason Industries, Type ND, with 0.35" static deflection under design load ratings.

3. Elements between the hoisting machine unitized base and machine support beams shall be similar to triple layer ribbed neoprene pads, separated by appropriate steel shims as manufactured by Mason Industries, Type W pads, at 50 durometer, loaded for 40 psi or approved equal.
4. All bolts through isolation elements, where necessary, are to incorporate resilient washers and bushings.
5. Isolation of existing hoisting machine and motor is contingent on the OEM design of the apparatus.
  - a. Existing isolation pads shall be replaced with new.

J. Sequential Transformer Contactor / Controller

1. Where step-up, step-down or isolation transformers are used, provide each elevator with an electrical disconnect panel located between the main line disconnect and the transformer.
2. The electrical disconnect panel shall have the following features:
  - a. A properly sized contactor to interrupt the main line wiring to the car transformer rated for a minimum of 500,000 operations.
  - b. An internal timer for contactor control adjustable from 5 to 30 seconds.
  - c. A push-activated emergency disconnect switch to deactivate the line contactor.
  - d. A timer bypass switch to manually bypass internal timer operation.
  - e. A jewel to indicate that the unit is active and the contactor is engaged.
  - f. Terminals for external supervisory control to facilitate group to group sequencing as required.
3. Mount the components in a ventilated NEMA rated cabinet or in the controller.
4. Mount the sequence controller in close proximity to, or bundled with, the isolation transformer enclosure.
  - a. Where conditions allow, the contactor may be installed within the confines of the controller cabinet.
  - b. Timing and bypass circuitry shall be located within the cabinet and properly identified.

K. Overhead / and Governor Stop Switches (New)

1. Provide a positive action stop switch at the following locations as required by applicable code:
    - a. Overhead sheave space.
    - b. Secondary level.
    - c. Overhead governor access panel as may be mandated by the AHJ.
  2. The switch shall be arranged to prevent the application of power to the hoist motor and machine brake when placed in the "OFF" position.
    - a. Clearly identify the switch with permanent marking on the switch cover that indicates "RUN" and "STOP" positions.
- L. Ascending Car Overspeed Protection Device (New)
1. Provide a device designed to prevent an ascending elevator from striking the hoistway overhead structure.
  2. The device shall decelerate the car with any load up to the rated capacity by applying an emergency brake.
    - a. The device shall detect an ascending car overspeed condition of not greater than 10% higher than the speed that the car governor is set to trip.
    - b. The device, when activated, shall prevent operation of the car until the device is manually reset.
    - c. The device shall meet the requirements of the ASME A17.1 Safety Code as may be modified by the AHJ.
- M. Unintended Car Movement Protection Device (New)
1. Provide a device to prevent unintended car movement away from the landing when the car and hoistway doors are not closed and locked.
    - a. The device shall prevent such movement in the event of failure of:
      - 1) The electric driving machine motor.
      - 2) The brake.
      - 3) The machine shaft or shaft coupling.
      - 4) Machine gearing.
      - 5) Control system.
      - 6) Any component upon which the speed of the car depends.
      - 7) Suspension ropes and the drive sheave of the traction machine are excluded.

- b. The device shall prevent operation of the car until the device is manually reset.
- c. The device shall meet the requirements of the ASME A17.1 Safety Code as may be modified by the AHJ.

N. Emergency Brake (New)

- 1. Provide a mechanical device, independent of the normal braking system that will stop the elevator should it overspeed or move in an unintended manner.
- 2. The device used may be arranged to apply force to the car or counterweight rails, suspension or compensation ropes, drive sheave or brake drum.
- 3. The emergency brake shall be provided with a marking plate indicating the range of total masses (car with attachments and its load) for:
  - a. The range of speeds at which it is set to operate.
  - b. The criteria such as rail lubrication requirements that may be critical to the performance.

2.5 HOISTWAY EQUIPMENT

A. Guide Rails / Inserts / Brackets (Reuse)

- 1. Car and counterweight guide rails, fish plates, rail brackets, backing support and related attachments shall be inspected to determine if unfavorable conditions exist that diminish the structural integrity of any component.
  - a. In the event substandard conditions are disclosed by means of this inspection, the Contractor shall immediately undertake whatever repairs and/or replacements may deem appropriate to remedy the situation.
- 2. Each stack of guide rails shall be individually examined to determine if excessive compression has occurred from building settlement.
  - a. In the event such conditions are found to exist, each affected stack shall be cut off enough to relieve pressure.
  - b. Jacking bolts shall be provided underneath each stack of both car and counterweight guide rails.
- 3. Each stack of guide rails shall be realigned so that total deviation from plumb in any direction does not exceed 1/8"



over the entire length of the hoistway and that DBG measurements never vary more than .030".

4. As required, car guide rails joints shall be individually filled, filed and sanded in order to eliminate minor variations in adjoining machined surfaces.

B. Counterweight Assembly (Reuse)

1. The existing counterweight assembly shall be refurbished to as new condition and reused.
2. Individual counterweight frame members shall be inspected for any indication of damage and to determine if the overall assembly is twisted, racked, or otherwise distorted.
  - a. All fastenings between counterweight frame members shall be individually examined, tightened and if necessary renewed.
  - b. In case any of these conditions are found to exist, the Contractor undertake whatever corrective action the Government may deem appropriate to remedy the situation.
3. The amount of filler weight placed within the counterweight frame shall be adjusted so the weight of the entire counterweight assembly is equal to that of the renovated elevator car, plus 40-42% of its rated loading capacity.
  - a. Filler weights shall be held securely in place at all times with tie rods passing through holes in both the weights and the counterweight frame with tie rods secured on each end with double lock nut and a cotter pin arrangement.

C. Roller Guides (New)

1. Provide roller guide shoes with adjustable mounting base, rigidly bolted to the top and bottom of each side of the car and counterweight frame.
  - a. Roller guides shall consist of a set of sound reducing neoprene wheels in precision bearings held in contact with the three finished rail surfaces by adjustable stabilizing springs.
  - b. The bearings shall be sealed or provided with grease fittings for lubrication.
  - c. Equip roller guides with adjustable stops to control postwise float.
  - d. Fit the top car roller guides with galvanized, painted or powder coated steel guards.

2. Approved applications and manufacturers:
  - a. Gearless traction elevators with speeds below 1000 fpm: ELSCO Model A for car roller guides and ELSCO Model C for counterweight guides, or approved equal.
3. Roller guides shall not be installed on counterweight frames where traveling buffers with separate guide shoes are employed and lubrication of the rails is necessary for quiet guide operation.
4. Roller guides shall not be installed on counterweight frames where counterweight safeties are employed and prevailing conditions prohibit installation due to limitations in clearances or in cases where rollers will interfere with the operation of the safety plank.

D. Hoist Ropes (New)

1. Pre-formed traction steel wire rope, specifically constructed for elevator applications, shall be provided for suspension of the elevator car and counterweight assembly.
  - a. Fastenings shall be accomplished by use of individual tapered rope sockets with adjustable shackles.
  - b. General design requirements for rope shackles and the method of securing wire rope shall conform to ASME A17.1 elevator safety code as modified by, and/or in addition to codes and standards accepted by the AHJ.
2. New ropes shall be identical in number and construction to those which are currently in use.
3. Rope shackle springs shall be replaced on elevators.
4. Provide new anti-spinout ropes as required by applicable code at all shackles where applicable.

E. Governor Ropes (New)

1. Pre-formed wire rope specifically constructed for elevator applications, shall be provided for governor ropes.
  - a. Rope shall be traction steel or iron in accordance with OEM design requirements.
  - b. Rope diameter and method of fastening shall be in accordance with ASME A17.1 Safety Code as adopted and/or otherwise modified by the AHJ.

F. Compensating Ropes (New)

1. Pre-formed wire ropes, specifically constructed for elevator applications, shall be provided for compensating ropes.
    - a. Compensating ropes shall be of sufficient diameter and number so as to offset the unbalanced weight of hoist ropes and traveling cables.
    - b. Fastenings shall be accomplished by use of individual tapered rope sockets with adjustable shackles.
      - 1) General design requirements for rope shackles and the method of securing wire rope shall conform to ASME A17.1 Safety Code as adopted and/or otherwise modified by the AHJ.
    - c. Variations in fastenings may apply based on O.E.M. design and duplication of existing fastening practices is required where necessary.
  2. Provide new anti-spinout as required by applicable code at all shackles.
- G. Electrical Conduit / Wiring / Traveling Cable (All Elevators - New)
1. Electrical wiring. (All Elevators - New)
    - a. All wiring shall be stranded copper conductors, manufactured in compliance with ANSI/ASTM B174-71 and UL 62 requirements, and polyvinyl chloride insulation complying with ETT requirements of UL 62 and Article 400 of the National Electric Code.
    - b. Electrical wiring provided for hoistway interlock shall be of a flame retardant type, capable of withstanding temperatures of at least 392 degrees Fahrenheit. Conductors shall be Type SF or equivalent.
    - c. Each run of electrical conduit or duct shall contain no less than 10% spare wires and, in any case, no fewer than two (2) spare wires.
    - d. Crimp-on type wire terminals shall be used where possible. Junction boxes on the car shall be equipped with terminal blocks. Terminal blocks having pressure wire connectors of the clamp type that meet UL 486A requirements for stranded wire may be used in lieu of terminal eyelet connections.
  2. Traveling cable. (All Elevators - New).
    - a. Each traveling cable shall be provided with a flame and water resistant polyvinyl chloride jacket.

- b. Electrical wiring shall consist of stranded copper conductors, manufactured in compliance with ANSI/ASTM B174-71 and UL 62 requirements, and polyvinyl chloride insulation complying with ETT requirements of UL 62 and Article 400 of the National Electric Code.
  - c. Each traveling cable shall contain no less than 10% spare wires.
  - d. Traveling cable exceeding 100' in length shall be provided with a steel wire rope support strand from which the cable shall be suspended.
  - e. Traveling cable must be contained within an approved electrical conduit to within 6' of the final suspension point in the hoistway.
  - f. Each traveling cable shall be arranged to provide no fewer than six (6) individually shielded pairs of 20-gauge wire and arranged to contain no less than two (2) RG6 coaxial cable, one (1) RG-6 Ethernet cable for Wi-Fi, and 2 pair (14 gauge) wires for CCTV power for CCTV remote monitoring.
  - g. Traveling cable conductors that terminate at a hoistway center box shall be connected to stud blocks provided for that purpose.
    - 1) Each wiring terminal shall be clearly identified by its nomenclature as shown on the "as built" wiring diagrams and solderless, crimp-on type wire terminals shall be used where possible.
  - h. The attachment of a traveling cable to the underside of the elevator car shall be performed so that a minimum loop diameter of 30x the cable diameter is provided.
  - i. Pre-hang the cables for at least 24 hours with ends suitably weighted to eliminate twisting during operation.
3. Rigidly supported EMT conduit, flexible metal conduit and galvanized steel trough shall be utilized throughout the hoistway.
- a. Both EMT and flexible conduit shall be connected on either end by use of compression fittings and secured in place with metal clamps sized in accordance with the diameter of conduit utilized.
    - 1) Wire or plastic wire ty-raps shall not constitute an acceptable means of fastening.
  - b. The use of flexible metal conduit shall be limited to runs not greater than 3' in length.

- c. All abandoned or unused electrical conduit shall be removed from the hoistway.
- d. If traveling cables come into contact with the hoistway or elevator due to sway or change in position, provide shields or pads to the elevator and hoistway to prevent damage to the traveling cables.
- e. Hardware cloth wide may be installed from the hoistway suspension point downward to the elevator pit to prevent traveling cables from rubbing or chafing. Hardware cloth shall be securely fastened and tensioned to prevent buckling. Hardware cloth is not required when traveling cable is hung against a flat wall.
- f. All wiring and electrical connections for CCTV (including future provisions) shall terminate in an electrical junction box located on a corner of the car top, final location to be approved by the Owner.
- g. All wiring and electrical connections for security operation in the car shall be terminated on stud blocks in the car operating panel.
- h. Existing conduit and wiring duct may be reused if suitable for the application.

- 1) Reuse of existing conduit/duct shall be at the discretion of the Government.

H. Normal and Final Terminal Stopping Devices (New)

- 1. Provide normal terminal stopping devices to stop the car automatically from any speed obtained under normal operation within the top and bottom overtravel, independent of the operating devices, final terminal stopping device and the buffers.
- 2. Provide final terminal stopping devices to stop the car and counterweight automatically from the speed specified within the top clearance and bottom overtravel.
- 3. The terminal stopping devices shall have rollers with rubber or other approved composition tread to provide silent operation when actuated by the cam fixed to the top of the car.
  - a. Terminal stopping devices that are not mechanically operated (i.e.: magnetic proximity) shall be provided by the manufacturer of the control equipment, intended for use as a terminal limit, and designed for reliable operation in the hoistway environment.
- 4. Final terminal limits shall be pinned so as to prevent movement after final adjustment where required by the AHJ.

I. Emergency Terminal Speed Limiting Device (New)

1. Provide necessary emergency terminal speed limiting devices where reduced stoke buffers are used.
  - a. Operation of the device shall be independent of the operation of the normal terminal stopping device.
  - b. Arrange the device to automatically reduce the car and counterweight speed by removing power from the driving machine motor and brake so that the rated striking speed of the buffer is not exceeded at the time of impact.
  - c. The sensing device shall be independent of the normal speed control system.
  - d. Short circuits caused by grounds or other conditions shall not prevent the operation of the device.

J. Overhead / Secondary Level Stop Switch (New)

1. Provide a positive action stop switch in the overhead sheave and/or secondary level as required by applicable code.
  - a. This switch shall be arranged to prevent the application of power to the hoist motor and machine brake when placed in the "OFF" position.
  - b. Clearly identify the switch with permanent marking on the switch cover that indicates "RUN" and "STOP" positions.

K. Emergency Terminal Stopping Device (New)

1. Provide necessary emergency terminal stopping devices where static motor control is used at speeds over 200 feet per minute.
  - a. Operation of the device shall be independent of the operation of the normal terminal stopping device.
  - b. Arrange the device to remove power from the driving machine motor and brake should the normal terminal stopping device fail to cause the car to slow down at the terminal as intended.

2.6 PIT EQUIPMENT

A. Car and Counterweight Buffers (New)

1. Provide buffer with necessary blocking and horizontal steel braces under the car and counterweight.

2. Provide spring type buffers for elevators with operating speeds of up to and including 200 fpm. Use oil buffers for elevators with operating speeds over 200 fpm.
3. Oil buffer shall bring the car and counterweight to rest from governor tripping speed at an average rate of retardation not exceeding gravity ( $32 \text{ ft/s}^2$ ).
4. Oil buffer shall be of the spring return type and shall have means of checking oil supply level.
5. Use reduced stroke buffer with associated terminal slowdown devices where run by is restrictive.
  - a. Buffer and emergency terminal slowdown device shall operate in accordance with applicable codes.
6. The buffer shall be tested and approved by a qualified testing laboratory prior to installation.
7. Provide a permanent buffer marking plate which indicates the manufacturer's name, identification number, rated impact speed and stroke.
8. Provide a permanent data plate in the vicinity of the counterweight buffer indicating the maximum designed counterweight run by.
9. Support buffers from the pit floor level with all required blocking and bracing steel members.
10. Coordinate the installation of the buffer inspection platform and ladder with the Owner and Construction Manager.

B. Inspection Platforms, Ladders, Guard Rails, Screens and Guards

1. Provide the following secondary metal work in the pit, hoistway and in elevator machine room in accordance with bid documents.
  - a. Wire mesh separator screen between two adjacent elevator pits located at different elevations.
  - b. Counterweight shall be guarded by means of a fixed screen from the pit floor to a position of at least 2450 mm (96") above pit floor.
  - c. Pit access ladders.
  - d. Buffer inspection platforms and ladders.
  - e. Guard rails and 60 degree ships ladders in machine room.
  - f. Guard around machine, ropes and rope holed.
  - g. Hoisting machine inspection and service platforms with handrails.
2. Submit detailed shop drawings of all miscellaneous metal items for Owners/Consultant's approval.

3. Provide painted sheet steel covers for all dead end hitches.
4. The pit ladder shall have continuous steel flat bar side rails 12 mm (1/2") x 75 mm (3"), with eased edges, spaced a minimum of 400 mm (16") apart. Rungs shall be steel bars 18 mm (3/4") in diameter, spaced 300 mm (12") apart with top to have a non-slip surface. Rungs shall be located along centerline of side rails, located not less than 180 mm (7") from the nearest permanent object or structure. Plug weld and grind smooth on outer rails faces. Support each ladder at top and bottom and at intermediate points spaced not more than 1500 mm (60"). Extend side rails 1200 mm (48") above top rung.
5. Prime paint and apply two (2) coats of rust inhibiting machinery enamel to metal work specified above as approved by the owner.

C. Compensating Sheave Assembly (Reuse)

1. The compensating sheave assembly shall be washed clean of accumulated grease and oil, then examined for any indication of bearing or bearing seal failure.
2. Bearings which are found to emit unusual noises, appreciable vibration, excessive heat, or other unfavorable characteristics during operation shall be replaced.
3. Defective grease retention seals shall be replaced as part of this scope of work.
4. Compensating sheave guide rails, supports and fastenings shall be inspected for damage and to determine if the structural integrity of any component is diminished by the effects of rust or other unfavorable conditions.
  - a. Where necessary, the Contractor shall undertake whatever repairs and/or replacements are necessary to remedy the situation.
5. Surface rust shall be removed from all reused components of the compensating sheave assembly prior to repainting.
6. The compensating sheave assembly shall be provided with manually reset electrical safety switches to trip prior to the sheave reaching the normal limit of its travel in either vertical direction.
  - a. When in the tripped position, the electrical safety switch shall remove power from the hoist motor and machine brake.
  - b. An existing electrical safety switch that meets the requirement set forth herein may be refurbished to as new condition and reused.



7. Where applicable, the existing compensating sheave tie-down shall be dismantled and inspected for any indication of damage or other unfavorable conditions that might interfere with their proper operation.
    - a. Where necessary, the Contractor shall undertake repairs and/or replacements to remedy the situation.
  8. Tie-down shall be lubricated as necessary and set to O.E.M. specifications upon completion of repairs.
- D. Governor Rope Tension Assembly (New)
1. Provide a governor rope tension assembly.
    - a. Maintain the proper tension in the governor rope with a weighted tension sheave located in the pit.
      - 1) Springs used to develop the tension are not acceptable.
    - b. The sheave shall be of proper diameter and set directly plumb with the governor rope drop to prevent the rope from pulling off of the sheave at an angle.
    - c. Lubrication fittings shall be provided on the assembly.
    - d. The assembly shall have necessary rope guards to prevent accidental contact of the rope/sheave by service personnel and to prevent the governor rope from jumping off of the sheave.
- E. Pit Stop Switch (New)
1. Where pit depth does not exceed 67", each elevator pit shall be provided with a push/pull or toggle switch that is conspicuously designated "EMERGENCY STOP" and located so as to be readily accessible from the hoistway entrance on the lowest landing served at a height of approximately 18" above the floor.
    - a. This switch shall be arranged to prevent the application of power to the hoist motor and machine brake when placed in the "OFF" position.
  2. Where climb-in pit depth exceeds 67", each pit shall be provided with two (2) push/pull or toggle switches conspicuously designated "EMERGENCY STOP".
    - a. Both of these stop switches, shall be located immediately adjacent to the pit access ladder.

- 1) Place one stop switch approximately 47" above the pit floor.
  - 2) Place the second stop switch 18" above the hoistway entrance sill on the lowest landing served.
  - 3) These switches shall be arranged so as to prevent the application of power to the hoist motor or machine brake when either one is placed in the "OFF" position.
3. Where a walk-in pit exists, each elevator shall be provided with a push/pull or toggle switch that is conspicuously numbered and designated "EMERGENCY STOP".
- a. The location of this stop switch shall be approximately 47" above the pit floor at the nearest point of pit entry from the access door.
  - b. This switch shall be arranged so as to prevent the application of power to the hoist motor and machine brake when placed in the "OFF" position.
4. Provide an electric contact safety switch for the pit access door if any equipment attached to the car extends within the space of the hoistway pit when the car is level at the bottom terminal landing.
- a. Opening the pit access door shall cause the electric contact switch stop the elevator by interrupting electric power to the driving machine and brake.
  - b. Provide a sign on the pit door "WARNING - OPENING OF PIT DOOR WILL STOP ELEVATOR" using lettering a minimum of 2 inches high.

## 2.7 Hoistway Entrances

### A. HOISTWAY ENTRANCES: NEW AT 2<sup>ND</sup> FLOOR CARS 8 & 9 (REAR)

1. Provide entrances of metal construction using cold rolled steel. Door frames shall be constructed of stainless steel. Complete entrances with sills, hanger supports, hangers, tracks, angle struts, unit frames, door panels, fascia plates, toe guards, hardware, bumpers, sight guards, and wall anchors.
2. Provide one piece extruded nickel silver sills with non-slip wearing surface, grooved for door guides and recessed for fascia plates. Sills shall have overall height of not less than 19 mm (3/4 in.), set true, straight, and level, with hoistway edges plumb over each other, and top surfaces

flush with finished floor. Grout sills full length after installation.

3. Construct hanger supports of not less than 4.5 mm (3/16 in.) thick steel plate, and bolted to strut angles.
4. Structural steel angles 127 mm x 127 mm x 13 mm (5 in. x 5 in. x 1/2 in.) shall extend from top of sill to bottom of floor beam above, and shall be securely fastened at maximum 457 mm (18 in.) on center and at each end with two bolts.
5. Provide jambs and head soffits, of not less than 14-gauge stainless steel, for entrances. Jambs and head soffits shall be welded construction, and provided with three anchors each side. Side jambs shall be curved type. Radius of curvature shall be 89 mm (3 1/2 in.). Head jamb shall be square type, and shall overhang corridor face of side jambs by 6 mm (1/4 in.). Rigidly fasten jambs and head soffits to building structure. Provide jambs with protective covering. After installation, protect jambs and head soffits with wood framing to prevent damage to finish during construction. Solidly grout jambs.
6. Provide 14-gauge sheet steel fascia plates in hoistway to extend vertically from head of hanger support housing to sill above. Plates shall be the same width as the door opening of elevator and adequately reinforced to prevent waves and buckles. Below bottom terminal landing and over upper terminal landing provide shear guards beveled back to and fastened to the wall. Where rear openings are used, provide shear guards and fascia plates the full height of the hoistway as required by ASME A17.1.
7. Provide hoistway entrance finished to match car 7 entrance at the same landing with flush two speed side slide hoistway doors for Elevators P 8 & 9. Door panels shall be not less than 16-gauge steel, flush type construction, and not less than 32 mm (1 1/4 in.) thick. Top and bottom of door panels shall have continuous stiffener channels welded in place. Reinforcement of the door panels shall be approximately 1.0 mm (0.04 in.) in thickness and of the hat section type. At bottom of each and every panel, provide two removable laminated phenolic gibs or other approved material guides and a separate fire gib. Reinforce each door panel for hangers, interlock mechanism, drive assembly, and closer. One door panel for each entrance shall bear a BOCA label, Underwriters' label, or in lieu of this, labels from other accredited test laboratories may be furnished provided they are based on fire test reports and factory inspection procedures acceptable to the COTR. Fasten sight guard of 14-gauge stainless steel, extending full height of panel, to leading edge of fast speed panel of two-speed doors

8. Provide hangers for hoistway door panels and provide relating devices to transmit motion from one door panel to the other. Fasten the hangers to the door sections. Provide reinforcements at the point of attachment. The hanger shall have provisions for vertical and lateral adjustments. Hang doors on two-point suspension hangers having sealed ball-bearing sheaves not less than 76 mm (3 in.) in diameter, with rubber or non-metallic sound-reducing tires mounted on a malleable iron or steel bracket. The hanger sheaves shall operate at a relatively low rotational speed, and shall roll on a high-carbon, cold-rolled or drawn steel track shaped to permit free movement of sheaves without regard to vertical adjustment of sheave, bracket or housing. Beneath the track and each hanger sheave, provide a hardened steel up-thrust roller capable of withstanding a vertical thrust equal to the carrying capacity of adjacent upper sheave. The up-thrust shall have fine vertical adjustments, and the face of the roller shaped so as to permit free movement of the hanger sheave. The up-thrust roller shall have ball or roller bearings. Provide the hanger sheaves with steel fire stops to prevent disengagement from tracks.
9. Do not use hangers that are constructed integrally with the door panels.
10. Provide raised numerals on cast, rear mounted plates for all openings. Numerals shall be a minimum of 50 mm (2 in.) high, located on each side of entrance frame, with centerline of 1524 mm (5 ft) above the landing sill. The number plates shall contain Braille.
11. Provide unique car number on every elevator entrance at designated main fire service floor level, minimum 76 mm (3 in.) in height. (New)

G. Hoistway Entrances (Reuse at all other landings)

1. Hoistway entrance sills, sill supports, entrance frames, headers and header supports shall be reused and refurbished.
  - a. Hoistway entrances that have become distorted or bent shall be straightened, plumbed, reset to the proper width dimension and reinforced as necessary.
  - b. Provide 14-gauge steel fascia plates that extend at least the full width of the door and be secured at hanger support and sill with oval head machine screws.
    - 1) Reinforce fascia to allow not more than  $\frac{1}{2}$ " of deflection.
    - 2) Provide fascia plates where the clearance between the edge of the loading side of the platform and

the inside face of the hoistway enclosure exceeds the code allowed clearance.

- c. Provide 14-gauge steel toe guards that extend 12" below any sill not protected by fascia.
  - 1) The toe guards shall extend the full width of the door and shall return to the hoistway wall at a 15-degree angle and be firmly fastened.
- d. Remove the inactive switch located in each entrance jamb and Install block out plates over the opening finished to match the entrance finish.
- e. Remove oil, dirt and impurities on new and existing apparatus and give a factory coat of rust inhibitive paint to all exposed surfaces of struts, hanger supports, covers, fascias, toe guards, dust covers and other ferrous metal.

H. Slide Type Hoistway Door / New in Existing Frame

- 1. Provide a new elevator hoistway entrance door reusing existing entrance frame.
- 2. Each new door shall be as follows:
  - a. Hollow metal construction
  - b. 1-1/2-hour fire-rated test approved with required label
  - c. Manufactured of cold rolled furniture steel
  - d. Flush design both sides
  - e. Rigidly reinforced
  - f. Sound deadened
- 3. Where conditions warrant, and where otherwise required by code, equip all hoistway landing doors with one-piece full height non-vision wings of material and finish to match hall side of door.
- 4. Provide each door panel with two removable laminated plastic composition guides, arranged to run in existing sill grooves with a minimum clearance.
  - a. The guide mounting shall permit their replacement without removing the door from the hangers.
  - b. A steel fire stop shall be enclosed in each guide.
- 5. Provide the meeting edge of center opening doors with necessary new continuous rubber astragal bumper strips.
  - a. Astragal shall be relatively inconspicuous when the doors are closed.

- b. Provide rubber bumpers at the top and bottom of each section of door to stop them at their limit of travel in the opening direction.
6. Provide a special key so that an authorized person can open any landing door when the car is elsewhere.
  - a. The key hole shall be not less than 3/8" in diameter and shall be fitted with a stainless steel ferrule to match related equipment.
7. Finish all door panels to match elevator entrances, stainless steel finish at 1<sup>st</sup> floor, and color as selected by Owner at all other floors.
8. Where conditions require, provide necessary new masonry around existing entrance frames to maintain fire rating.

I. Tracks / Hangers / Closers / Related Equipment (New)

1. Formed or extruded steel landing door hanger tracks shall be provided.
2. Each landing door panel shall be suspended from a pair of door hanger assemblies that are compatible with the hanger tracks.
  - a. Hanger assemblies shall be directly mounted to the door panel using 3/8" diameter or better hardware.
  - b. Solid steel blocks shall be used where job-site conditions dictate the use of spacers between hanger assemblies and the landing door panel.
  - c. Hanger assemblies shall be adjusted or shimmed so that door panels are suspended in a plumb manner with no more than 3/8" vertical clearance to the cab entrance threshold.
  - d. Upthrust rollers shall be adjusted for minimal operating clearance against the bottom edge of the hanger track.
  - e. Means shall be provided to prevent hangers from jumping the track.
  - f. Blocks shall be provided to prevent rollers from overrunning the end of the track.
3. Each set of center opening landing doors shall be provided with a cable driven relating mechanism which is compatible for use with the door hanger assemblies.
  - a. The relating mechanism shall be properly tensioned and adjusted so as to equalize the relationship between the door panels and the hoistway entrance.

4. Each set of single, multi-speed, center opening or side slide landing doors shall be provided with a sill-mounted spring closing mechanism with necessary door panel relating hardware.
5. Where applicable, each hoistway door interlock assembly shall be provided with an emergency release mechanism utilizing manufacturers' standard type access key at all landings served.
  - a. Drill each hoistway door to accommodate manufacturers standard lock release key and install escutcheon.
    - 1) Escutcheon shall be brushed stainless steel to match door panels where required.
    - 2) Aluminum shall be provided at all other typical floors.
6. Where multi-speed side slide door panels exist, provide a secondary interlocking device that will prevent separation of the panels should the sill closer or relating cable(s) fail.

J. Interlocks / Unlocking Devices (New)

1. Each set of landing doors shall be provided with a complete electromechanical interlock assembly.
  - a. Each interlock assembly shall consist of:
    - 1) A switch housing with contacts
    - 2) Lock keeper
    - 3) Clutch engagement/release subassembly
    - 4) Associated linkages
  - b. Arrange the lock so that individual leading door panels (side slide or center opening) are locked when in the closed position.
2. Non-typical mounting arrangements for interlocks and/or related mechanisms must receive prior approval from the Government.
3. Each hoistway door interlock assembly shall be provided with an emergency release mechanism utilizing a drop-leaf type access key at all landings served.
  - a. Each hoistway door shall accommodate manufacturer's standard lock release key with escutcheon.
    - 1) The key hole shall be fitted with a metal ferrule that matches the door finish.

- 2) Drilling key holes in the field will not be accepted.

K. Hoistway Door Bottom Guides / Safety Retainers (New)

1. The bottom of each side sliding type hoistway door panel shall be equipped with a minimum of two (2) guiding members.
  - a. Metal mounting angles shall be secured to the integral panel frame structure; and when conditions warrant, additional external metal support plates or angles shall be installed to ensure the integrity of the panel frame is not compromised.
  - b. Guides shall be manufactured of low friction non-metal material with sufficient strength to withstand forces placed on door panels per ASME A17.1 Standards.
  - c. Each guide assembly shall incorporate a steel wear indicator and be so designed to permit sliding member replacements without removal of door panel(s) from top hanger devices.
  - d. Panels shall be hung with a maximum vertical clearance of 3/8 inch between top of sill and bottom of panel and the guide shall engage the sill groove by not less than 1/4 inch.
2. The bottom of each side sliding type hoistway door panel shall be equipped with a guiding member safety retainer to prevent displacement in the event of primary guide means failure.
  - a. A metal reinforcement (12 gauge stainless or galvanized steel) shall be installed between the two (2) primary guiding members (a.k.a. "Z" bracket).
  - b. The reinforcement shall be designed with a minimum length of 8 inches or the maximum possible length that will fit between the primary members and a minimum overall height of 2.5 inches secured on the internal face of the door panel. (Hoistway side)
  - c. The retainer shall be set with the supplemental safety angle 3/8 inch into the corresponding sill groove; and be capable of preventing displacement of the panel no more than 3/4 inch with an applied force of 1125 lbf at right angles over an area 12 inches x 12 inches at the approximate center of the door panel.

2.8 CAR EQUIPMENT / FRAME

A. Car Frame (Reuse)



1. The existing car frame assembly shall be refurbished to as new condition and reused.
2. Individual car frame members, platform isolation framework, door operator support structure, related bracing and hardware shall be inspected for any indication of damage or distortion.
  - a. Where damage is detected, the Contractor shall immediately inform the Government and then undertake corrective action deemed appropriate by the Government to remedy the condition.
3. Provide new elastomer isolation pads for all existing platforms where pads are presently installed.
4. The car frame, door operator support and related bracing shall be modified or reconfigured as necessary in order to accommodate new cab enclosure and/or master door operating equipment specified herein.
5. The elevator car shall undergo static balancing upon substantial completion of all work described in the project specifications and subsequent to any car interior refinishing or cab replacement work performed in conjunction with the project.
6. The 2:1 rope sheave shall be refurbished:
  - a. The sheave shall be washed clean of accumulated grease and oil.
  - b. Bearings which are found worn or to emit unusual noises, appreciable vibration, excessive heat, or other unfavorable characteristics shall be replaced.
  - c. Defective grease retention seals shall be replaced as needed.
  - d. Provide means to ensure that hoist ropes cannot jump out of their respective grooves in case of a slack rope condition.

B. Car Platform (Reuse)

1. The existing platform shall be modified to accommodate the new apparatus specified herein.
  - a. Where necessary, the underside of platform shall be refurbished and treated with fire-rated material.
  - b. Top of platform shall be refurbished with a marine grade plywood set to receive new finished floor covering as selected by Owner.
  - c. Where necessary, provide a new safety access hole ring and cover assembly to match selected cab finishes.
  - d. At Contractor's option or when conditions warrant, provide a totally new platform in lieu of repairs, modifications and upgraded specified above.

C. Load Weighing Device (New)

1. Provide means to measure the load in the car within an accuracy of  $\pm 4\%$  of the elevator capacity.
2. Provide one of the following types of devices:
  - a. A device consisting of four strain gauge load cells located at each corner of the car platform and supporting a free floating car platform and cab with summing circuits to calculate the actual load under varying conditions of eccentric loading.
  - b. A strain gauge device located on the crosshead, arranged to measure the deflection of the crosshead and thus determine the load in the car.
  - c. A device consisting of four strain gauge load cells, supporting the weight of the elevator machine with summing circuits to calculate the actual load under varying conditions of load.
  - d. A device to measure the tension in the elevator hoist ropes and thus determine the load in the car.
3. Arrange that the output signal from the load weighing device be connected as an input to the signal and motor control systems to pre-torque of the hoisting machine motors where applicable.
4. Provide audible and visual signals in connection with the load weighing device as an "overload" device.
5. Provide an indicator light in the car operating panel to operate during an overload condition.
6. Provide overload audible announcement via speech in car indicating an overload condition.

D. Automatic Leveling / Releveling / Positioning Device (New)

1. Equip the elevator with a floor leveling device which shall automatically bring the car to a stop within 1/4" of any floor for which a stop has been initiated regardless of load or direction of travel.
2. This device shall also provide for releveling which shall be arranged to automatically return the elevator to the floor in the event the elevator should move below or above floor level in excess of 1/4".
3. This device shall be operative at all floors served and whether the hoistway or car door is open or closed provided there is no interruption of power to the elevator.
4. A positioning device shall be part of the controller microprocessor systems.
  - a. Position determination in the hoistway may be through fixed tape in the hoistway or by sensors fitted on each driving machine to encode and store car movement.
  - b. Design the mechanical features and electrical circuits to permit accurate control and rapid acceleration and retardation without discomfort.

E. Top-of-Car Inspection Operating Station (New)

1. An inspection operating station shall be provided on top of the elevator car.
2. This station shall be installed so that the controls are plainly visible and readily accessible from the hoistway entrance without stepping on the car.
3. When the station is operational, all operating devices in the car shall be inoperative.
4. Provide the following control devices and features:
  - a. A push/pull or toggle switch designated "EMERGENCY STOP" shall be arranged so as to prevent the application of power to the hoist motor or machine brake when in the "off" position.
  - b. A toggle switch designated "INSPECTION" and "NORMAL" to activate the top of car Inspection Service Operation.
  - c. Push button designated "Up", "Down" and "Enable" to operate the elevator on Inspection Service (the "Enable" button shall be arranged to operate in conjunction with either the "Up" or "Down" button).
  - d. An indicator light and warning buzzer that are subject to activation under Phase I - Fire Emergency Recall Operation.

F. Emergency Exits / Top and Side

1. Ensure they operate as per code and have proper electrical contacts and mechanical locks on the exterior of the cab enclosure.
2. No other key to the building shall unlock the emergency exit lock except access switch keys which may be keyed alike.
  - a. Keys shall be assigned in accordance with ASME A17.1 Group 1 Security requirements.

G. Car Enclosure Work Light (LED)/ Receptacle (New)

1. The top and bottom of each car shall be provided with a permanent lighting fixture and 110 volt GFI receptacle.
2. Light control switches shall be located for easy accessibility from the hoistway entrance.
3. Where sufficient overhead clearance exists, the car top lighting fixture shall be extended no less than 24" above the crosshead member of the car frame.
4. LED Light bulbs shall be guarded so as to prevent breakage or accidental contact.

H. Master Door Power Operator System - VVVF/AC (New)

1. Provide a heavy-duty master door operator on top of the elevator car enclosure for power opening and closing of the cab and hoistway entrance door panels.
2. Operator shall utilize an alternating current motor, controlled by a variable voltage, variable frequency (VVVF) drive and a closed-loop control with programmable operating parameters.
  - a. System may incorporate an encoder feedback to monitor positions with a separate speed sensing device or an encoderless closed-loop VVVF-AC control to monitor motor parameters and vary power applied to compensate for load changes.
3. The type of system shall be designated as a high speed operator, designed for door panel opening at an average speed of 2.0 feet per second and closing at approximately 1.0 foot per second.
  - a. Reduce the closing speed as required to limit kinetic energy of closing doors to within values permitted by ASME A17.1 as may be adopted and/or modified by the AHJ.

4. The door shall operate smoothly without a slam or abrupt motion in both the opening and closing cycle directions.
  - a. Provide controls to automatically compensate for load changes such as:
    - 1) Wind conditions (stack effect)
    - 2) Use of different weight door panels on multiple landings
    - 3) Other unique prevailing conditions that could cause variations in operational speeds.
  - b. Provide nudging to limit speed and torque in conjunction with door close signaling/closing and timing devices as permitted by ASME A17.1 as may be adopted and/or modified by the AHJ. Nudging shall be initiated by the signal control system and not from the door protective device.
5. In case of interruption or failure of electric power from any cause, the door operating mechanism shall be so designed that it shall permit emergency manual operation of both the car and corridor doors only when the elevator is located in the floor landing unlocking zone.
  - a. The hoistway door shall continue to be self-locking and self-closing during emergency operation.
  - b. The door operator and/or car door panel shall be equipped with safety switches and electrical controls to prevent operation of the elevator with the door in the open position as per ASME A17.1 Code Standards.
  - c. Provide zone-lock devices as required by ASME A17.1 as may be adopted and/or otherwise modified by the AHJ.
6. Construct all door operating levers of heavy steel or reinforced extruded aluminum members, designed for stress and forces imposed on the related parts, linkages and fixed components during normal and emergency operation functions.
  - a. All pivot points shall have either ball or roller-type bearings, oilite bronze bushings or other non-metallic bushings of ample size.
7. Provide operating data / data tag permanently attached to the operator as required by applicable code and standards.

I. Car Door Panel(s) (New)

1. Provide standard 1" thick, 14-gauge hollow metal flush construction panel(s), reinforced for power operation and insulated for sound deadening.
2. Paint the hoistway side of each panel black and face the cab side with 16-gauge stainless steel matching new stainless steel returns.
3. The panels shall have no binder angles and welds shall be continuous, ground smooth and invisible.
4. Drill and reinforce panels for installation of door operator hardware, door protective device, door gibs, etc.
  - a. Provide each door panel with two removable laminated plastic composition guides, arranged to run in the sill grooves with minimum clearance.
  - b. The guide mounting shall permit their replacement without removing the door from the hangers.
5. Provide the meeting edge of center opening doors with necessary continuous rubber astragal bumper strips.
  - a. These strips shall be relatively inconspicuous when the doors are closed.

J. Door Reopening Device / "3D"(New)

1. Provide a combination infrared curtain and 3D door protection system.
2. The door shall be prevented from closing and will reopen when closing if any one of the curtain light rays is interrupted or should an object enter the 3D detection zone.
3. The door shall start to close when the protection system is free of any obstruction.
4. The infrared curtain and 3D zone protective system shall provide:
  - a. Protective curtain field not less than 71" above the sill.
  - b. 3D protective zone field not less than 61" above the sill.
  - c. Accurately positioned infrared lights to conform to the requirements of the applicable handicapped code.
  - d. Modular design to permit on board test operation and replacement of all circuit boards without removing the complete unit.
  - e. Self-contained, selectable 3D zone timeout feature to allow for closing at nudging speed with audible signal.
  - f. Automatic turning-off of the 3D zone in the event of three (3) consecutive 3D triggers.

- 1) Light curtain shall continue to operate after 3D system timeout.
- g. Selectable control of the 3D zone operation on an "always-on" or "as doors close" basis.
- h. Controls to shut down the elevator when the unit fails to operate properly.
5. Existing infrared door protection system, designed in accordance with the criteria specified herein, may be retained and refurbished for new subject to the Government's review and approval.

## 2.9 FINISH AND MATERIALS

### A. Hoistway Entrances Finish and Design

1. Hoistway entrances and door panels shall be finished as shown on the project drawings.
2. Where no finish is specified, finishes shall be baked enamel primer gray.
3. Refer to specifications for other design requirements.

### B. Car Interior Finishes

1. Car interior finishes shall be as shown on the project drawings.
2. Contractor shall provide samples of finishes as required for approval prior to fabrication.
3. Refer to specifications for other design requirements.
4. Special attention shall be given to flooring materials and suitability for intended duty.

### C. Material, Finishes and Painting

#### 1. General

- a. Cold-rolled Sheet Steel Sections: ASTM A366, Commercial Steel, Type B
- b. Rolled Steel Floor Plate: ASTM A786
- c. Steel Supports and Reinforcement: ASTM A36
- d. Aluminum-alloy Rolled Tread Plate: ASTM B632
- e. Aluminum Plate: ASTM B209
- f. Stainless Steel: ASTM A167 Type 302, 304 or 316
- g. Stainless Steel Bars and Shapes: ASTM A276
- h. Stainless Steel Tubes: ASTM A269
- i. Aluminum Extrusions: ASTM B221
- j. Nickel Silver Extrusions: ASTM B155
- k. Bronze Sheet: ASTM B36 (36M) alloy UNS No. C2800 (Muntz Metal)

- l. Structural Tubing: ASTM A500
- m. Bolts, Nuts and Washers: ASTM A325 and A490
- n. Laminated / Safety Tempered Glass: ANSI Z97.1

2. Finishes

a. Stainless Steel

- 1) Satin Finish: No. 4 satin, long grain

b. Sheet Steel:

- 1) Shop Prime: Factory-applied baked on coat of mineral filler and primer
- 2) Finish Paint: Two (2) coats of low sheen baked enamel, color as selected by the Owner.
- 3) Steel Equipment: Two (2) coats of manufacturer's standard rust-inhibiting paint to exposed ferrous metal surfaces in both the hoistway and pit that do not have galvanized, anodized, baked enamel, or special Architectural finishes.

3. Painting

- a. Apply two (2) coats of paint to the machine room floor.
- b. Apply two (2) coats of clear lacquer to bronze or similar non-ferrous materials to prevent tarnishing during a period of not less than twelve (12) months after initial acceptance by the Owner or Agent.
- c. Identify all equipment including buffers, crosshead, safety plank, machine, controller, drive, governor, disconnect switch, etc., by 4" high numerals which shall contrast with the background to which it is applied. The identification shall be either decalcomania or stencil type.
- d. Paint or provide decal-type floor designation not less than six (6) inches high on hoistway doors (hoistway side), fascias and/or walls as required by A17.1 Rule 100.7 at intervals not exceeding 7'-0". The color of paint used shall contrast with the color of the surface to which it is applied.

D. Designation and Data Plates, Labeling and Signage.

1. Provide an elevator identification plate on or adjacent to each entrance frame where required by the AHJ.
  - a. The designation numeral shall be a minimum of 3" in height.



2. Provide floor designation plates at each elevator entrance, on both sides of the jamb at a height of 60 inches to center line of plate. Mechanical fasteners shall be used in addition to industrial adhesives.
  - a. Floor number designations and Braille shall be 2" high, 0.03" raised and stud mounted.
3. Provide raised designations and Braille markings to the left of the car call and control buttons of the car operating panel(s).
  - a. Designations shall be a minimum of 5/8" high, 0.03" raised and stud mounted.
4. Provide elevators with data and marking plates, labels, signages and refuge space markings complying with A17.1 Elevator Safety Code as may be adopted and/or otherwise modified by the AHJ.
5. Owner shall select the designation and data plates from manufacturer's premium line of plates.

## 2.10 FIXTURES / SIGNAL EQUIPMENT

### A. General - Design and Finish

1. The design and location of the hall and car operating and signaling fixtures shall comply with the ADAAG.
2. The operating fixtures shall be selected from the manufacturer's premium line of fixtures and shall be illuminated by ultra-bright white LED's.
3. The operating fixtures for the Service Elevators 5 & 6 will be selected from the manufacturer's premium line of vandal resistant fixtures.
4. A working sample of the fixture buttons will be provided to the owner and VDA, prior to production.
5. Custom designed operating and signaling fixtures shall be as shown on the drawings or as approved by the Owner/VDA.
6. Custom designed operating and signaling fixtures shall be as shown on the drawings or as approved by the Owner / Owner.
7. The layout of the fixtures including all associated signage and engraving shall be as approved by the Government and the VA Owner's Representative.
8. Where no special design is shown on the drawings, the buttons shall be as follows:
  - a. Passenger Elevators

- 1) Typical Floors: 1/8" thick stainless steel faceplate with No. 4 finish.
- 2) Ground Floor: Custom designed stainless steel faceplate with No. 4 finish.

b. Service Elevator 5&6

- 1) All Floors: 1/8" thick stainless steel vandal resistant with No. 4 finish and tamperproof screws.
9. Mount passenger elevator fixtures with tamperproof or concealed fasteners and service elevator fixtures with tamperproof screws. The screw and key-switch cylinder finishes shall match faceplate finish.
  10. Where key-operated switch and or key-operated cylinder locks are furnished in conjunction with any component of the installation, four (4) keys for each individual switch or lock shall be furnished, stamped or permanently tagged to indicate function.
  11. All caution signs, code mandated instructions and directives shall be engraved and filled with epoxy.

B. Main Car Operating Panel (New)

1. Provide a main car operating push button panel on the inside front return panel of the car.
2. Car operating panel shall be flush mounted with swing type, one-piece faceplate with heavy-duty concealed hinges.
  - a. Mount all key switches that are required to operate and maintain the elevators exposed on the car station except those specified within a locked service cabinet.
3. The push buttons shall become individually illuminated as they are pressed and shall extinguish as the calls are answered.
4. The operating panel shall include:
  - a. A call button for each floor served.
  - b. "Door open" / "Door close" buttons.
  - c. Adjustable "Door Hold" button with range of 10 seconds to 99 seconds.
  - d. "Alarm" button (Interfaced with emergency alarm).
  - e. Full speech voice annunciator capabilities.
  - f. Overload signal indicator include speech announcement when active.
  - g. "Emergency Stop" switch per local law.

- h. Self-dialing, hands-free telephone and/or intercom with call acknowledging feature and ADA design provisions.
  - i. Firefighters' telephone jack and emergency communication provisions, as required per local code.
  - j. Interactive security features utilizing a card reader system, provided by this contractor.
  - k. Code blue "in-car" card reader and visual indicator signal with audible alarm. The signage will use "medical emergency" in the signal indicators.
  - l. Locked Firemen's Service cabinet, keyed in accordance with local Code, containing required devices (including fire phone jacks) and signals in accordance with ASME A17.1 Standards.
  - m. Automatic opening of the locked cabinet door may be provided with signals initiated by the fire detection and alarm system where approved by the Authority Having Jurisdiction.
5. Provide a locked service cabinet flush mounted and containing the key switches required to operate and maintain the elevator, including, but not limited to:
- a. Independent/Attendant service switch with associated operating buttons and signal indicators.
  - b. Light switch.
  - c. Fan switch.
  - d. G. F. I. duplex receptacle.
  - e. Emergency light test button and indicator.
  - f. Inspection Service Operation key switch.
  - g. Port for hand-held service tool where applicable.
  - h. Dimmer for cab interior lighting.
6. Car operating panel shall incorporate:
- a. An integral (no separate faceplate) digital L.E.D. floor position indicator
  - b. Emergency light fixture (without a separate faceplate) and black-filled engraved unit I.D. number or other nomenclature, as approved by Owner
  - c. A "No Smoking" advisory and the rated passenger load capacity.
7. Provide a dedicated space within the car operating panel for a proximity card reader device to disconnect the corresponding floor push button. Design and location to be determined by owner and Government. Engraving, as approved by the owner, will be included in the card space designations. A removable flush mount face plate shall be integrated in the main car operating panel, with final

design as approved by the owner. Any required mounting provisions will be included in the panel for existing and future applications.

8. Equip the car operating panel with security car call keyed switches OR proximity card reader to disconnect the corresponding floor push button.
  - a. Security system shall be overridden by Phase II Firefighter's Emergency Operations in accordance with code.
9. Where posting of an advisory is permitted by the Governing Authority in lieu of the inspection certificate, engrave the following advisory on the hinged cover of the service cabinet, or where otherwise directed by the Owner.
  - a. Elevator Certificate is On File in Building Management Office.

C. Auxiliary Car Operating Panel (New - Match Existing)

1. Provide an auxiliary car operating panel that contains the following:
  - a. Car call registration buttons.
  - b. Door open and close buttons.
  - c. Door hold button
  - d. Illuminated alarm button.
2. Operating devices shall be of the same design, material and finish as the main operating panel.
3. The auxiliary horizontal car operating panel will be an option for all elevators of the current configuration. Final layout of the panel will be reviewed and approved by the owner and Government.
4. Design this station so as to duplicate the layout of the existing auxiliary car operating panel.

D. Car Position Indicator (New)

1. The position of the car in the hoistway shall be indicated by the illumination of the position indicator numeral corresponding to the floor at which the car has stopped or is passing.
  - a. Provide 2:" high, 10-segment LED type position indicator with direction arrows, integral with the car operating panel.
  - b. Provide Lexan cover lens with hidden support frame behind fixture plate to protect the indicator readout.

- c. Provide audible floor passing signal per ADA standard where not provided by the elevator signal control.
- d. Flush mount fixture with cover to match selected car front or car operating panel.

E. Voice Annunciator (Speech)(New)

1. Provide a voice annunciator in each elevator.
2. Coordinate size, shape and design with Designer and other trades.
3. The system shall include, but not limited to:
  - a. Solid state digital speech annunciator
  - b. A recording feature for customized messages
  - c. Male and female voice capabilities
  - d. Playback option
  - e. Built-in voice amplifier
  - f. Master volume control
  - g. Audible indication for selected floor, floor status or position, direction of travel, floor stop and nudging.
4. Locate all associated equipment in a single, clearly labeled enclosure located either in the machine room and/or on car top.

F. Hospital Emergency Service Car Operating Devices (Code Blue)

1. The car control card reader shall be capable of providing on and off signals to activate and deactivate Hospital Service.
2. Provide an illuminated advisory indicator with audible signal in the car operating panel.

G. Corridor Push Button Stations / Riser (New - Match Existing Conditions)

1. A riser of push button signal fixtures shall be provided on all floors.
2. Each signal fixture shall consist of the following:
  - a. A flush-mounted faceplate sized to cover existing opening in wall covering.
  - b. Illuminating tamper-resistant push buttons measuring 3/4" at their smallest dimension as selected by the Owner.
  - c. A recessed mounting box, electrical conduit and wiring.
3. Intermediate landings shall be provided with fixtures containing two (2) push buttons while terminal landings

- shall be provided with fixtures containing a single push button.
4. Include firefighter key switch in the main lobby level station or other designated recall landing.
  5. Push button signal fixtures shall be installed with the buttons at a centerline height of 42" above the floor and shall be installed both plumb and flush to the finished wall.
  6. Provide a digital floor position indicator with 2" high numerals at all landings served.
  7. All cutting, patching, grouting and/or plastering of masonry walls resulting from the removal or installation of corridor fixtures shall be performed by the Contractor so as to maintain the fire rating of the hoistway.
    - a. Finished painting or decorating of wall surfaces shall be by this contractor.
  8. All faceplates shall be engraved with fire logo and "In Case of Fire Use Stairs" to help fill the void created by the use of oversized covers.
- H. Hospital Emergency Service Corridor Operating Devices (Code Blue)
1. Provide card reader to activate the Hospital Emergency Service with illuminated jewel indicator and engraved faceplate at all landings.
- I. Hall Direction Lanterns / (All Elevators - All Floors)/ Floor Position indicator Basement and 1<sup>st</sup> floor only.
1. Provide a visual and audible signal at each entrance to indicate the direction of travel and, where applicable, which car shall stop in response to the hall call.
    - a. Design the lantern with up and down indication at intermediate landings and a single indication at terminal landings.
    - b. Lanterns shall sound once for the up direction and twice for the down direction.
      - 1) Provide an electronic chime with adjustable sound volume.
    - c. Provide adjustable signal time (3 to 10 seconds, with 1 second increments) to notify passengers which car shall answer the hall call and preset per ADAAG distance standards.

2. All floors shall include a fixture that shall incorporate a 2" high LED floor position indicator in the hall lantern fixture with direction arrows located on both sides of the indicator.
3. Locate the lantern above / adjacent to the corridor entrance as noted on the drawings. .

J. Hoistway Access Switch (New)

1. Install a cylindrical type keyed switch at top terminal in order to permit the car to be moved at slow speed with the doors open to allow authorized persons to obtain access to the top of the car.
2. Where there is no separate pit access door, a similar switch shall be installed at the lowest landing in order to permit the car to be moved away from the landing with the doors open in order to gain access to the pit.
3. Locate the switch in the terminal floor entrance jambs without faceplate at a height of 78" above the finished floor in existing locations, as applicable. Existing key switches will be replaced with new assemblies in this application.
4. Locate the switch in a separate fixture with a flush cover plate at a height of 78" above the finished floor in non-jamb existing installations. Cover plate shall be of a design and style as approved by the Owner, the Owner's representative or Owner.
5. This switch is to be of the continuous pressure spring-return type and shall be operated by a cylinder type lock having not less than a five (5) pin or five (5) disc combination with the key removable only in the "OFF" position.
  - a. The lock shall not be operable by any key which operates locks or devices used for other purposes in the building and shall be available to and used only by inspectors, maintenance men and repairmen in accordance with A17.1 applicable Security Group.
6. Existing provisions that meet the aforementioned criteria may be updated with keyed switches to match new apparatus provided for uniformity of systems within the building.

K. Lobby Control Panel (New)

1. Provide a Lobby Control Panel for elevators P1 through P10 located in the fire command security station in the fire command room as noted on the drawings.
2. Provide stainless steel faceplate with tamperproof screws.
3. The panel shall include:
  - a. 2" high LCD car position and travel direction indicators.
  - b. Master intercom station / telephone.
  - c. Three (3) position (on/car to lobby/off) switches.
  - d. Emergency power controls and indicators as per code requirements.
  - e. "Car at the designated floor with its doors open" indicator.
  - f. System trouble indications.
  - g. Car call floor lockout switches.
  - h. Floor lockout switches as herein further specified.
  - i. Car to lobby key switches.

L. Lift-Net Elevator Management Information System (New - All Elevators)

1. The data collection, data storage and real-time monitoring portion of the system shall be based on Microsoft Windows, and able to run on Windows 7 or later operating systems.
2. The system shall:
  - a. Be network-based and be capable of interfacing with all makes and types of elevator control systems.
  - b. Collect data via either serial data link or hardwired interface connections.
  - c. Be capable of operating on any TCP/IP based network system including but not limited to Ethernet, Token Ring, Arc-net and Lift-Net.
  - d. Allow the addition of unlimited monitoring terminals on the network.
3. Monitoring terminals shall operate "peer to peer" without a single server, and the failure of a single network device shall not affect the operation of the rest of the system.
4. The system shall provide multiple banks, including multiple buildings, on a single monitoring terminal screen.
5. All monitored banks shall be visible from any monitoring terminal on the network.
6. Entry into the network shall be multi-level password protected.



- a. The system shall be capable of real time display of all monitored status points on all monitored equipment.
- b. Fault and event notification screens and audible alarms shall be immediately displayed on selected monitoring stations.
- c. Different fault and event tables shall be defined on a per-bank basis.
- d. The system shall collect and store all status, fault and event information for later reporting and analysis.
- e. The system shall provide statistical analysis of hall call response times, traffic patterns, fault conditions, service logs and security usage in graphical and tabular format.
- f. The system shall maintain a record of every status point change occurring on the monitored equipment, and provide the ability to replay these events in a simulation at a later time in real time, slow speed, single step, reverse, or fast forward.
  - 1) This information shall be retained for a period of at least twenty-six weeks, and a mechanism shall be provided whereby this information may be archived.
- g. The system shall store traffic, fault and statistical data for a period of at least three (3) years.
  - 1) The system shall log error type, car number, floor position and major system status points whenever a fault or logged event occurs.
- h. The system shall provide interactive control of certain features provided in the elevator control system which may be revised as the requirements of the building change.
- i. Interactive controls shall include but are not limited to:
  - 1) Security floor lockouts
  - 2) Entering car and hall calls
  - 3) Firefighter's return service
  - 4) Lobby recall
  - 5) VIP service
  - 6) Suspicious person / security return
  - 7) Up/Down peak
  - 8) Hospital Code Blue service (per local codes). Local codes may affect the availability or operation of these features.

- j. In the case of a power failure the system shall be capable of connecting to an emergency power back-up unit without the loss of any stored data.
7. The system will automatically re-boot the program and continue to operate after a power loss or other system malfunction.
8. The Elevator Monitoring Equipment shall have the following minimum characteristics:
  - a. Monitoring Station Hardware
    - 1) Central processing unit - IBM compatible microcomputer - desk top or mini-tower (multiple machine rooms or lobby displays)
    - 2) Type - Pentium or most current high-performance processor
    - 3) Speed - most current high-performance
    - 4) Internal hard drive - adequate storage for three years' data for entire system
    - 5) Modem - most current high-performance
    - 6) Display - color, capable of simultaneous display of all monitored units
    - 7) Printer - current HP Color Desk Jet Series
    - 8) Keyboard - MS Windows compatible
    - 9) Mouse - MS Windows compatible
    - 10) Power requirements - 90 - 230 Volts AC 50 - 60Hz
  - b. Machine Room Hardware
    - 1) Controller interface panels with high quality printed circuit boards
    - 2) Input voltage range - 5 - 250V AC/DC
    - 3) Compatible with all types and makes of controllers
    - 4) Operating temperature range - 45 - 112 degrees Fahrenheit
    - 5) Humidity range - 10% - 85% non-condensing
    - 6) Modular design - capable of future expansion
    - 7) Power requirements - 90 - 230 VAC 50 - 60Hz @ 3A
9. The system shall display and record the following information for each monitored unit: (The following is intended as a guideline - connections to each status point mentioned on every control system may be impractical. Serial data links may include many more points.)
  - a. Group operational mode
  - b. Multiple groups or buildings on the same screen
  - c. In/out of service

- d. In/out of group service
- e. Emergency power
- f. Supervisory failure
- g. Location and direction of hall calls
- h. Individual car status - expandable menus
- i. Direction of travel
- j. Independent service
- k. Inspection service
- l. Fire service
- m. Position of elevator
- n. Door status (open, opening, closing, closed)
- o. Door dwell time
- p. Load by-pass
- q. Emergency power
- r. Power on/off
- s. Door detector
- t. Safety circuit
- u. Door zone
- v. Stop switch
- w. Alarm button
- x. Registered Car Calls

10. Keyboard, Mouse and time clock control capabilities

- a. Floor lockouts (car or hall)
- b. Lobby recall
- c. VIP service
- d. Firefighter's service
- e. Hospital Code Blue
- f. Up/Down Peak
- g. User defined parameters (minimum eight (8) inputs)

11. Faults monitored with visual and audible alarm, triggered by combinations of any of the above status points

- a. Safety circuit
- b. Alarm bell
- c. Door reversal device
- d. Earthquake
- e. At least six user selectable faults or events

M. Security Cameras (All Elevators)

- 1. Provide all required wiring from a common point (junction box) on the elevator controller in the machine room to a common point (junction box) on the car top. Connect new cameras provided and installed under this contract to this junction box.

N. Emergency Power Control Panel

1. Provide the lobby console or other designated location with a control panel for emergency power operation as further specified.
  - a. An emergency power control panel provided at the designated location.
  - b. The panel shall contain:
    - 1) An indicator light that illuminates when a transfer to emergency power takes place.
    - 2) Indication that the elevators have arrived at the designated landing and have parked with the doors maintained in the open position.
    - 3) Key-operated override switches and a manual selector switches identified with positions for each elevator.
2. The control panel shall be engraved so as to identify the function of each control feature and device provided.
3. The Elevator Contractor shall provide all necessary electrical conduit and wiring between the elevator machine room(s), and the Emergency Power Control Panel.

2.11 CAR ENCLOSURES

A. Elevator Cab

1. Car Shell and Panels
  - a. The car sides and rear wall shall be constructed of No. 14-gauge steel. Apply sound-deadening material to the outside face of the shell. Sound deadening material shall be of the rubberized type and shall be of either brush or spray-on consistency. Material shall be applied to a minimum of 1/8" thickness. Side emergency exit, where applicable, shall be provided per local laws.
  - b. The car top shall be of no less than No. 12-gauge sheet steel suitably braced to meet the requirements of the A17.1 Code and painted white. Exit shall include hinging and locking arrangements of top emergency door with electrical safety switch to prevent operation with door open.
  - c. The transom shall be constructed of 14-gauge metal finished consistent with materials used for the return panels. The wall panels shall be constructed of 3/4" thick marine grade plywood.

- d. Each panel section shall be faced with a selected laminate/veneer or other material and framed in 1/16" thick stainless steel.
  - e. Frame members shall be separated by 1/2" thick polished metal trim and fitted with 3-1/2" by 3-1/2" polished metal plates at corners.
  - f. Apply furniture steel or suitable laminate to shaft side of panels to prevent warping or other deformations.
  - g. Provide a finished metal base with a 1/4" wide continuous vent slot above the base to allow the proper amount of air to infiltrate the cab based on the CFM of the exhaust fan and car interior size. Prepare base to accept finished floor.
2. Base:
- a. Provide a finished metal base with a 1/4" wide continuous vent slot above the base to allow the proper amount of air to infiltrate the cab based on the CFM of the exhaust fan and car interior size.
  - b. Prepare base to accept finished floor of flexible terrazzo tile as specified in this document.
3. Entrance Sill (New):
- a. Provide car door entrance saddle using a nickel-silver sill.
4. Lighting:
- a. Provide protective covers that allow service/maintenance from inside the cab area and sufficient to provide code-required lighting within the cab. Fixtures to be designed to provide indirect lighting.
5. Flooring:
- a. Replace any damaged subflooring for acceptance new flooring. Thickness to be determined with the flush mounting requirements of the car sill.
6. Handrail:
- a. Provide standard 1/2" x 2" polish flat-stock stainless steel handrail on all walls with top of rail located 32 inches above the finished floor.

- b. Provide a lower handrail mounted to protect the walls from wheelchair and cart traffic using ½" X 6 inch flat stock stainless steel on all walls.
  - c. Use three (3) points of attachment designed for interior access servicing with exterior support plates.
7. Protection Pads:
- a. Provide floor-to-ceiling vinyl pads for all wall surfaces with associated hanging hardware.
8. Cab Doors: Standard 1" thick, 14-gauge hollow metal flush construction, reinforced for power operation and insulated for sound deadening. Paint hatch side of doors black and face cab side with 16-gauge sheet stainless steel.
- a. The door panels shall have no binder angles. All welds shall be continuous, ground smooth and invisible.
  - b. Drill and reinforce doors for installation of door operator hardware, door protective device, door gibs, etc.
9. Ceiling:
- a. Suspended ¼" thick white diffuser in stainless steel frame as shown on the drawings.
10. Ventilation: The ventilation system of the exhaust type shall be provided in each elevator.
- a. The system shall include a blower driven by a direct connected motor and mounted on top of car with isolation to effectively prevent transmission of vibration to the car structure. The blower shall have not less than two operating speeds. The ventilation system shall be sized to provide one air change per minute at low speed and 1.5 air changes per minute at high speed. The unit design and installation shall be such that the maximum noise level, when operating at high speed, shall not exceed 55 dBA approximately three feet above the car floor. A two-position switch to control the blower shall be provided in the car station.
  - b. The blower shall start upon the pressing of a car or landing call button and shall stop a predetermined time (approximately 2 minutes) after the car has answered the last registered call.

11. Lighting: Arrange LED lighting fixtures and ceiling assembly to provide indirect illumination without hot spots and shadows.
  - a. Design and configure lighting system to facilitate maintenance of the fixtures.
  - b. The service and freight elevators shall have not less than 40-foot candle illumination at 48" above the finished floor with the doors closed.
12. Handrails: All attachment hardware shall match the selected handrail and shall permit handrail removal from within the cab.
  - a. Provide a minimum of 10-gauge plate at the hatch side of the shell, aligned with the handrail attachment points, to assure secure handrail mounting.
  - b. Design handrail attachment system to support the weight of a person (250 pounds) sitting on it without any deflection and damage to the handrail, cab panel and the shell.
13. Protective Pads and Pad Hooks: Provide pad hooks at locations as directed by the Owner. Protective pads shall cover the front return panels, and the side and rear walls. Provide cutouts in pads for access to the cab operating and signaling devices. Pads shall be fire-resistant canvas with two (2) layers of cotton batting padding.
  - a. Identify each pad by elevator number and wall location.
  - b. Provide storage bags for the pads for each elevator with elevator number plainly marked on the outside.
14. Accessories: Construct elevator cab to accommodate the door operator, hangers, interlocks and all accessory equipment provided under other sections of these specifications, including firefighter phones, card readers and CCTV.
15. All cab materials shall conform to the code prescribed flame spread rating and smoke development requirements.

B. Cab Fabrication and Installation

1. Maintain accurate relation of planes and angles with hairline fit of contacting panels and/or surfaces.
2. Any shadow gaps (reveals) between panels shall be consistent and uniform.
3. Unless otherwise specified or shown on the drawings, for work exposed to view use concealed fasteners.
4. Maximum exposed edge radius at corner bends shall be 1/16". There shall be no visible grain difference at the bends.

5. Form the work to the required shapes and sizes with smooth and even curves, lines and angles. Provide necessary brackets, spacers and blocking material for assembly of the cab.
6. Interior cab surfaces shall be flat and free of bow or oil canning. The maximum overall deviation between the low and high points of 24" x 24" panel section shall not exceed 1/32".
7. Make weights of connections and accessories adequate to safely sustain and withstand stresses to which they will be subjected.
8. All steel work except stainless steel and bronze materials shall be painted with an approved coat of primer and one (1) coat of baked enamel paint.
9. Canopy: Paint canopy with a coat of primer and one coat of low sheen enamel paint.
10. Front Return Panels and Transom: Stainless steel fixed type front return panel.
  - a. Provide stainless steel entrance posts having mitered, welded and ground smooth corners.
11. Cab Doors: Stainless steel with No.4 finish.
12. Ceiling:
  - a. Suspended ¼" thick white diffuser in stainless steel frame as shown on the drawings.
13. Base: Provide a 4" high base in the material and finish shown on the drawings at the sides and rear of the cab enclosure.
14. Lighting: Minimum of three (3) rows of LED strip lights similar to fluorescence fixtures shall be provided equally spaced across the width/depth of the car.

C. Service Elevators

1. Lower Wall Panels: 4'-0" high, 1/8" thick diamond tread aluminum wainscoting on all walls. Mount panels with countersunk stainless steel screws. The wainscoting shall be demountable from within the car.
2. Upper Wall Panels: 16-gauge stainless steel applied to shell.
3. Provide oval vent slots 4" above the floor.
4. Canopy: Paint canopy with a coat of primer and one coat of enamel paint.
5. Front Return Panels and Transom: Stainless steel with No. 4 finish.
6. Cab Doors: Stainless steel with No. 4 finish.



7. Lighting: Provide a minimum of three (3) rows of LED strip lights recessed in the ceiling equally spaced across the width/depth of the cab with LED fixtures.
8. Handrails: Double row of 1/2" stainless steel bars at 12" and 32" above floor on side and rear walls. Mount rails to cabs at 12" on centers and arrange them to be removable from within car. Suitably reinforce cab panel to provide for secure handrail mounting.
9. Flooring: Furnish aluminum diamond plate flooring securely fastened to the platform with flush screws. Flooring must be removable for repair/replacement.

D. Elevator Cab Enclosure Fan

1. Provide an exhaust type multi speed fan unit with cover grill, mounting accessories and necessary cab enclosure modifications.
  - a. Fan unit shall include self-lubricating motor with housing rubber mounted for sound vibration isolation.
2. Provide key switch in the elevator cab enclosure for speed control of the fan unit.
3. Provide necessary wiring and approved conduit to properly connect fan unit with power source and control key switch.

2.12 EMERGENCY LIGHTING / COMMUNICATIONS / SIGNALING

A. Battery Back-Up Emergency Lighting Fixture and Alarm

1. Arrange two (2) of the LED cab light fixtures to operate as the emergency light system.
2. Provide a car-mounted battery unit including solid-state charger and testing means enclosed in common metal container.
  - a. The battery shall be rechargeable nickel cadmium with a 10-year minimum life expectancy. Mount the power pack on the top of the car.
  - b. Provide a 6" diameter alarm bell mounted directly to the battery/charger unit and connected to sound when any alarm push button or stop switch in the car enclosure is operated.
  - c. The bell shall be configured to operate from power supplied by the building emergency power generator. The bell shall produce a sound output of between 80-90 dBa (measured from a distance of 10') mounted on top of the elevator car.

- 1) Activation of this bell shall be controlled by the stop switch and alarm button in the car operating station
  - 2) The alarm button shall illuminate when pressed.
2. Where required by Code for the specific application, the unit shall provide mechanical ventilation for at least one (1) hour.
  3. The operation shall be completely automatic upon failure of normal power supply.
  4. Unit shall be connected to normal power supply for car lights and arranged to be energized at all times so it automatically recharges battery after use.

B. Common Alarm Bell

1. Provide a common alarm bell located in the elevator pit.
  - a. The bell shall be configured to operate when the alarm or stop switch of any elevator is activated, during both normal and battery back-up power conditions.
  - b. Existing common alarm bells may be rehabilitated and reused providing they meet the intent of this section and applicable codes.

C. Emergency Voice Communication / Telephone (New - All Elevators)

1. A hands-free emergency voice communication system shall be furnished in each car mounted as an integral part of the car operating panel.
  - a. Necessary wires shall be included in the car traveling cable and shall consist of a minimum of one shielded pair of 20AWG conductors.
  - b. 120V power shall be provided to power the hands-free device.
2. The telephone shall be equipped with an auto-dialer and illuminating indicator which shall illuminate when a call has been placed and begin to flash when the call has been answered.
  - a. Engraving shall be provided next to the indicator which says "When lit help is on the way".
3. In addition to the standard "Alarm" button, a separate activation button shall be provided on the car operating panel to initiate the emergency telephone and place a call.

- a. The telephone must not shut off if the activating button is pushed more than once.
  - b. The telephone shall transmit a pre-recorded location message only when requested by the operator and be provided with an adjustable call time which can be extended on demand by the operator.
  - c. Once two-way communication has been established, voice prompts shall be provided which instruct the operator on how to activate these functions as well as alerting the operator when a call is being attempted from another elevator in the building.
4. The system shall be compatible with ring down equipment and PBX switchboards.
  5. The system shall be capable of serving as the audio output for an external voice annunciation system.
    - a. Conversation levels shall measure 60 dbA or higher and measure 10 dbA above ambient noise levels.
    - b. Each device shall be provided with a self-diagnostic capability in order to automatically alert building personnel should an operational problem be detected.
  6. The phone shall be able to:
    - a. Receive incoming calls from any On-Site Rescue Station (when provided or required).
    - b. Receive incoming calls from other off-site locations via the public telephone system.
    - c. Acknowledge incoming calls and automatically establishing hands-free two way communications.
      - 1) If no On-Site Rescue Station is provided, each hands-free device shall have built in line consolidation which will allow up to 6 elevators to be called individually from outside the building over a single telephone line and up to 80 elevators if an On-Site Rescue Station is provided.
  7. The emergency elevator communication system shall require a maximum of one telephone line.
    - a. The system must provide line sharing capability to eliminate the need for a dedicated telephone line.
    - b. The line sharing function must ensure that the emergency telephones always receive dialing priority even if the line is in use and that the emergency telephones can be called into from an off-site location.

8. The system shall provide its own four hour backup power supply in case of a loss of regular AC power.
9. The system must provide capability for building personnel to call into elevators and determine the charge state of any backup batteries provided for the emergency telephones.
10. Pushing the activation button in any of the elevator car stations will cause any on-site Rescue Station (where provided or required) or security telephone to ring.
  - a. If the on-site call is not picked up within 30 seconds, the call will be automatically forwarded to a 24 hour monitoring station. Number to be provided by the COR.
11. All connections from the junction box to the telephone system shall be done by the Elevator Contractor where existing provisions can be reused.
12. New telephone lines, where required, shall be provided and interfaced by this contractor.
13. All connections from the junction box to the security room's main telephone system shall be done by this contractor.
14. All electrical work shall conform to Division 16 requirements.

D. Central Exchange Communication System / Intercom (EMS5)

1. Provide an ADA compatible, hands-free intercommunication system for all elevators for two-way, multi-path communication between the elevator car stations and master stations using a central exchange design system.
2. The communication system shall include:
  - a. A car station in each elevator.
  - b. A master station in each machine room to communicate with the central and satellite monitor panels, and with each car within its group.
  - c. A master station in the Engineers Room to communicate with all stations in the system.
  - d. A master station located in the fire command room to communicate with all stations in the system.
3. The car station shall have a loudspeaker and a microphone to provide hands-free communication. The station shall be installed behind the car operating panel.
4. Master stations shall include:
  - a. Selector push buttons
  - b. Annunciator lights for each connected station

- c. Speaker/microphone
  - d. Volume control and function buttons.
5. Install one master station in the remote monitoring panel with other master stations being the desk-mount type.
  6. The master stations shall communicate with other master stations and any elevator in that group.
  7. A call shall be placed from the elevator car station by pressing the emergency call or alarm button.
    - a. This action shall cause the lamp in the corresponding button of all the designated master stations to flash and an intermittent tone to be heard.
    - b. When the incoming call is answered, the flashing light shall go to a steady condition.
    - c. Disconnection of a call is simply done by depressing the designated car button once.
    - d. If a call request is placed during a conversation, it shall be indicated by a flashing light and short tone of every designated master station.
    - e. When the original conversation is completed, the normal intermittent tone shall resume.
  8. A master station shall be connected to any of its designated car stations by depressing the corresponding call button.
    - a. The lamp in the button shall be illuminated while the button is depressed.
    - b. In the car station an audible tone shall be emitted and immediate communication is established.
    - c. The call shall be ended by depressing the button a second time, disconnecting the circuit.
    - d. The master stations shall call any other master station by depressing the corresponding call button.
    - e. The button shall lock in its down position and the lamp shall be lit with a steady light.
    - f. At the called master station, a short tone shall be sent out and the lamp in the button corresponding to the "calling" party shall be lit.
    - g. After the tone, immediate communication is established.
  9. On all non-called master stations, the lamps corresponding to the calling and called stations shall be illuminated as an indication that those stations are busy.
  10. Provide all power supplies, wire, conduit, fittings, etc., for both systems.
  11. Location of the stations, in the specified rooms or areas, shall be directed by the Owner.

12. The intercom system shall include the following features:

- a. Test button to verify audio circuit path.
- b. All call buttons to initiate a call to all cars in the systems.
- c. Priority button in the remote monitoring panel stations.
- d. Visual acknowledgment for the hearing impaired.

13. Provide a battery backup power supply for the intercom capable of providing sufficient power to operate the complete system for a minimum of four (4) hours.

E. Firefighters' Two-Way Telephone Communications System

1. Provide a complete two-way telephone communications system for point-to-point communications between authorized personnel.
2. Provide firefighter telephone jack in the car operating panel in accordance with the requirements of the local authorities. The box shall be fitted with a flush mounted door having hairline joints.
3. Connection devices (jacks) and all associated wiring shall be provided by the elevator Contractor as part of the base bid.
4. The handsets shall be self-powered and not require an external power source for operation.

- a. The existing firefighter phone shall be reused.

F. Life Safety System / Hospital Intercom (Reuse existing)

1. Reinstall Life Safety System speaker in each elevator cab.
2. Provide all necessary wiring and interfacing between the elevator system and the Life Safety System as required.
3. The Life Safety System speaker shall be furnished under Division 16.

**PART 3 - EXECUTION**

3.1 EXAMINATION

A. Inspection

1. Study the Contract Documents with regard to the work as specified and required so as to ensure its completeness.
2. Examine surface and conditions to which this work is to be attached or applied and notify the Owner in writing if

conditions or surfaces are detrimental to the proper and expeditious installation of the work. Starting the work shall imply acceptance of the surfaces and conditions to perform the work as specified.

3. Verify, by measurements at the job site, dimensions affecting the work. Bring field dimensions which are at variance with those on the accepted shop drawings to the attention of the Owner. Obtain the decision regarding corrective measures before the start of fabrication of items affected.
4. Cooperate in the coordination and scheduling of the work of this section with the work of other sections so as not to delay job progress.

### 3.2 INSTALLATION

#### A. Installation

1. Modernize the elevators, using skilled personnel in strict accordance with the final accepted shop drawings and other submittals.
2. Comply with the code, manufacturer's instructions and recommendations.
3. Coordinate work with the work of other building functions for proper time and sequence to avoid delays and to ensure right-of-way of system. Use lines and levels to ensure dimensional coordination of the work.
4. Accurately and rigidly secure supporting elements within the shaftways to the encountered construction within the tolerance established.
5. Provide and install motor, switch, control, safety and maintenance and operating devices in strict accordance with the submitted wiring diagrams and applicable codes and regulations having jurisdiction.
6. Ensure sill-to-sill running clearances do not exceed 1 ¼" at all landings served.
7. Arrange door tracks and sheaves so that no metal-to-metal contact exists.
8. Reinforce hoistway fascias to allow not more than 1/2" of deflection.
9. Install elevator cab enclosure on platform plumb and align cab entrance with hoistway entrances.
10. Sound isolate cab enclosure from car structure. Allow no direct rigid connections between enclosure and car structure and between platform and car structure.
11. Isolate cab fan from canopy to minimize vibration and noise.

12. Remove oil, dirt and impurities and give a factory coat of rust inhibitive paint to all exposed surfaces of struts, hanger supports, covers, fascias, toe guards, dust covers and other ferrous metal.
13. Prehang traveling cables for at least 24 hours with ends suitably weighted to eliminate twisting after installation.
14. Pack openings around oil line with fire resistant, sound isolating glass or mineral wool.
15. Provide isolation pad between platen head and car structure.
16. Set jack unit plumb in waterproof hole and bolt it to mounting channels in the pit.
17. Sound isolate pump units and controllers from building structure.
18. After installation, touch up in the field, surfaces of shop primed elements which have become scratched or damaged.
19. Lubricate operating parts of system as recommended by the manufacturer.

B. Removal of Elevators

1. If extenuating circumstances (i.e. separating controller interconnections, inspection, testing, etc.), require that multiple cars of a single elevator group be removed from service simultaneously, the work shall be performed outside of the normal business hours at a time mutually agreed to by the Owner and Contractor.
2. A minimum of five (5) days advance written notice shall be given to the Owner and Elevator Consultant by the Contractor detailing the reasons for the simultaneous removal of the elevators from service along with the estimated out-of-service time.
3. The request shall be subject to review by the Elevator Consultant and approved by the Owner prior to the commencement of the work.
4. Costs for this work in addition to associated expenses shall be included as part of the base bid pricing.

C. Transfer of Hall Button Risers

1. Transfer of the hall button riser(s) to the new signal control systems shall be performed on a not-to-interfere basis and shall not interrupt building operations or inconvenience building occupants.
2. Costs for this work in addition to associated expenses shall be included as part of the base bid pricing. (including overtime if needed)

3.3 FIELD QUALITY CONTROL



A. Inspection and Testing

1. Upon completion of each work phase or individual elevator specified herein, the Contractor shall, at its own expense, arrange and assist with inspection and testing as may be required by the VA.

B. Substantial Completion

1. The work shall be deemed "Substantially Complete" for an individual unit or group of units when, in the opinion of the Consultant, the unit is complete, such that there are no material and substantial variations from the Contract Documents, and the unit is fit for its intended purpose.
2. Governing authority testing shall be completed and approved in conjunction with inspection for operation of the unit; a certificate of operation or other required documentation issued; and remaining items mandated for final acceptance completion are limited to minor punch list work not incorporating any life safety deficiencies.
3. The issuance of a substantial completion notification shall not relieve the Contractor from its obligations hereunder to complete the work.
4. Final completion cannot be achieved until all deliverables, including but not limited to training, spare parts, manuals, and other documentation requirements, have been completed.

C. Contractor's Superintendent

1. The Contractor shall assign a competent project superintendent during the work progress and any necessary assistant, all satisfactory to the Owner. The superintendent shall represent the Contractor and all instructions given to him shall be as binding as if given to the Contractor.
2. In accordance with RAF 52.236-6, at all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the worksite a competent superintendent who is satisfactory to the Contracting Officer and has authority to act for the Contractor.

3.4 PROTECTION / CLEANING

A. Protection and Cleaning

1. Adequately protect surfaces against accumulation of paint, mortar, mastic and disfiguration or discoloration and damage during shipment and installation.
2. Upon completion, remove protection from finished surfaces and thoroughly clean and polish surfaces with due regard to the type of material. Work shall be free from discoloration, scratches, dents and other surface defects.
3. The finished installation shall be free of defects.
4. Before final completion and acceptance, repair and/or replace defective work, to the satisfaction of the Owner, at no additional cost.
5. Remove tools, equipment and surplus materials from the site.
6. Any existing material that is not used for the modernization project is to be removed before the final completion, including all material currently located in the machine room, hoistways, secondary spaces and pits.

B. Barricades and Hoistway Screening

1. The Contractor shall provide barricades where necessary in order to maintain adequate protection of areas in which work specified by the Contract Documents is being performed, including open hoistway entrances. Fabrication and erection as all barricades shall be in compliance with applicable OSHA regulations.
2. As required, the Contractor shall provide temporary wire mesh screening in the hoistway and of any elevator undergoing work specified in the Contract Documents. This screening shall be installed in such a manner as to completely segregate the hoistway from that of adjacent elevators. Screening shall be constructed from .041" diameter wire in a pattern that rejects passage of a 1" diameter ball.

3.5 DEMONSTRATION

A. Performance and Operating Requirements

1. Passenger elevators shall be adjusted to meet the following performance requirements:
  - a. Speed: within 3% of rated speed under any loading condition.
  - b. Leveling: within 1/4" under any loading condition.
  - c. Typical Floor-to-Floor Time: Recorded from the doors start to close on one floor until they are 3/4 open at the next floor.

Group Passenger Elevators 9 - 11 seconds.

d. Door Operating Times:

Door Type	Opening	Closing
42" x 84" center opening	1.6 sec.	2.3 sec.
42" x 84" side opening	2.5 sec.	3.8 sec.
48" x 84" side opening	3.0 sec.	4.5 sec.

- e. Door dwell time for hall calls: 4.0 sec with Advance lantern signals
- f. Door dwell time for hall calls: 5.0 sec without Advance lantern signals
- g. Door dwell time for car calls: 3.0 seconds
- h. Reduced non-interference dwell time: 1.0 second

2. Maintain the following ride quality requirements for the passenger elevators:

- a. Where pit permits, extend bottom roller guides by not less than one half the distance from the centerline of the upper roller guides to the platform.
- b. Noise levels inside the car shall not exceed the following:
  - 1) Car at rest with doors closed and fan off - 40 dba.
  - 2) Car at rest with doors closed, fan running - 55 dba.
  - 3) Car running at high speed, fan off - 50 dba.
  - 4) Door in operation - 60 dba.
  - 5) Sound isolation: Noise level relating to elevator equipment operation in the machine room shall not exceed 80 dBA. All dBA reading shall be taken three (3) feet off the floor and three (3) feet from equipment.
  - 6) Airborne Noise: Measured noise level of the elevator equipment during operation shall not exceed 50 dBA in elevator lobbies and 60 dBA inside the car under any conditions including door operation and car ventilation exhaust blower on its highest speed.
- c. Vertical accelerations shall not exceed 20 milli-g and horizontal accelerations shall not exceed 20 milli-g.
  - 1) The accelerometer used for this testing shall be capable of measuring and recording acceleration to

nearest 0.01 m/s<sup>2</sup> (1 milli-g) in the range of 0-2 m/s<sup>2</sup> over a frequency range from 0-80 Hz with ISO 8041 filter weights applied. Accelerometer should provide contact with the floor similar to foot pressure, 60 kPA (8.7psi).

- d. Amplitude of acceleration and deceleration shall not exceed 4.0 ft/sec<sup>2</sup>.
- e. A sustained jerk shall not be more than twice the acceleration.
- f. The rate of change in the acceleration/deceleration rate shall not be greater than 8.0 ft/sec<sup>3</sup>.

B. Pre-Tests and Acceptance Testing

- 1. Comply with the requirements of Division 01.
- 2. The Contractor shall provide at least five (5) days prior written notice to the Owner and Consultant regarding the exact date on which work specified in the Contract Documents will reach completion on any single unit of vertical transportation equipment.
- 3. Pre-test the elevators and related equipment in the presence of the Resident Engineer or his authorized representative for proper operation before requesting final inspection. Conduct final inspection at other than normal working hours, if required by Resident Engineer.
  - a. Procedure outlined in the Inspectors Manual for Electric Elevators, ASME A17.2 shall apply.
  - b. Final test shall be conducted in the presence of and witnessed by a third party ASME QEI-1 Certified Elevator Inspector, contracted by the VA.
  - c. Government shall furnish electric power including necessary current for starting, testing, and operating machinery of each elevator.
- 4. Contractor shall furnish the following test instruments and materials on-site and at the designated time of inspection: properly marked certified test weights, voltmeter, amp probe, thermometers, direct reading tachometer, megohm meter, vibration meter, sound meter, light meter, stop watch, and a means of two-way communication.
- 5. Inspect workmanship, equipment furnished, and installation for compliance with specification.
- 6. Balance Tests: The percent of counterbalance shall be checked by placing test weights in car until the car and counterweight are equal in weight when located at the mid-point of travel. If the actual percent of counter balance does not conform to the specification, the amount of

- counterweight shall be adjusted until conformance is reached.
7. Full-Load Run Test: Elevator shall be tested for a period of one hour continuous run with full contract load in the car. The test run shall consist of the elevator stopping at every floor, in either direction of travel, for not less than five or more than ten seconds per floor.
  8. Speed Test: The actual speed of the elevator shall be determined in both directions of travel with full contract load and no load in the elevator. Speed shall be determined by applying a certified tachometer to the car hoisting ropes or governor rope. The actual measured speed of the elevator with all loads in either direction shall be within three (3) percent of specified rated speed. Full speed runs shall be quiet and free from vibration and sway.
  9. Temperature Rise Test: The temperature rise of the hoisting motor shall be determined during the full load test run. Temperatures shall be measured by the use of thermometers. Under these conditions, the temperature rise of the equipment shall not exceed 50 degrees Centigrade above ambient temperature. Test shall start when all machine room equipment is within five (5) degrees Centigrade of the ambient temperature. Other tests for heat runs on motors shall be performed as prescribed by the Institute of Electrical and Electronic Engineers.
  10. Car Leveling Test: Elevator car leveling devices shall be tested for accuracy of leveling at all floors with no load in car and with contract load in car, in both directions of travel. Accuracy of floor level shall be within plus or minus 3 mm (.125 in.) of level with landing floor for which the stop has been initiated regardless of load in car or direction of travel. The car leveling device shall automatically correct over travel as well as under travel and shall maintain the car floor within plus or minus 3 mm (.125 in.) of level with the landing floor regardless of change in load.
  11. Brake Test: The action of the brake shall be prompt and a smooth stop shall result in the up and down directions of travel with no load and rated load in the elevator. Down stopping shall be tested with 125 percent of rated load in the elevator.
  12. Insulation Resistance Test: The elevator's complete wiring system shall be free from short circuits and ground faults and the insulation resistance of the system shall be determined by use of megohm meter, at the discretion of the Elevator Inspector conducting the test.
  13. Safety Devices: Car and counterweight safety devices shall be tested.

14. Overload Devices: Test all overload current protection devices in the system at final inspection.
15. Limit Stops:
  - a. The position of the car when stopped by each of the normal limit switches with no load and with contract load in the car shall be accurately measured.
  - b. Final position of the elevator relative to the terminal landings shall be determined when the elevator has been stopped by the final limits. The lower limit stop shall be made with contract load in the elevator. Elevator shall be operated at inspection speed for both tests. Normal limit stopping devices shall be inoperative for the tests.
16. Oil Buffer Tests: These tests shall be conducted with operating device and limit stops inoperative and with contract load in the elevator for the car buffer and with no load in the elevator for the counterweight buffer. Preliminary test shall be made at the lowest (leveling) speed. Final tests shall be conducted at contract speed. Buffers shall compress and return to the fully extended position without oil leakage.
17. Operating and Signal System: The elevator shall be operated by the operating devices provided and the operation signals and automatic floor leveling shall function in accordance with requirements specified. Starting, stopping and leveling shall be smooth and comfortable without appreciable steps of acceleration or deceleration.
18. Performance of the Elevator supervisory system shall be witnessed and approved by the elevator inspector and a representative of the Resident Engineer.
19. If equipment fails test requirements and a re-inspection is required, the Contractor shall be responsible for the cost of re-inspection; salaries, transportation expenses, and per-diem expenses incurred by the elevator inspector and representative of the Resident Engineer.

END OF SPECIFICATION

**SECTION 14 24 00**  
**HYDRAULIC ELEVATORS**

**PART 1 - GENERAL**

1.1 SUMMARY AND DEFINITIONS

A. Related Documents

1. Section 01 33 23 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
2. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-rated construction.
3. SECTION 09 06 00, SCHEDULE FOR FINISHES: As a master format for construction projects, to identify interior and exterior material finishes for type, texture, patterns, color and placement.
4. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirements for seismic restraint of non-structural components.
5. Section 14 99 00, Elevator Maintenance Requirements
6. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.
7. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.
8. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
9. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.
10. Section 26 24 16, PANELBOARDS: Low voltage panelboards.
11. Section 26 51 00, INTERIOR LIGHTING: Fixture and ballast type for interior lighting.

B. Intent

1. This section includes:
  - a. One (1) hydraulic Passenger Elevator (Elevator 10).
2. The following outlines the scope of work covered in this section: The complete modernization of the equipment identified herein including but not limited to the replacement of the controllers, hydraulic machine, car and hall fixtures, new central control panel and wiring as

specified. Related equipment shall be designed, constructed, installed and adjusted to produce the highest results with respect to smooth, quiet, convenient and efficient operation, durability, economy of maintenance, and the highest standard of safety.

3. It is not the intent of these specifications to detail the construction and design of all parts of the equipment, but it is expected that the type, materials, design, quality of work and construction of each part shall be adequate for the service required, durable, properly coordinated with all other parts, and in accordance with the best commercial standards applicable and of the highest commercial efficiency possible.
4. Electric and magnetic circuits and related parts shall be of proper size, design and material to avoid heating and arcing, and all other objectionable effects which may reduce the efficiency of operation, economy of maintenance and/or net-useful life of the apparatus.
5. Minimum requirements for design, materials, etc., are for certain parts of the equipment. Equivalent requirements approved by the Government shall apply to such parts as are of special design, construction or material and to which the specified requirements are not directly applicable. These minimum requirements as a whole shall be considered as establishing proportionate general minimum standards for all parts of the equipment.
6. General requirements for design, materials and construction are intended primarily to apply to the heavy-duty and important parts of the equipment specifically mentioned and to other parts of similar duty and importance. Less important and light-duty parts may be of the standard design, materials and construction provided that, in the opinion of the Government, such standards are in accordance with the best commercial practice and are fully adequate for the purpose of use. All such variations shall be made only on the Government's written approval.
7. All equipment and component parts installed, supplied or provided under this contract shall be manufactured and distributed by a third-party, non-installer Company servicing the vertical transportation industry.
  - a. Apparatus shall conform to the design and construction standards referenced herein, and shall be rated the best commercial grade suitable for this application.
  - b. Equipment and component systems shall not employ any experimental devices or proprietary designs that could hamper and/or otherwise prohibit subsequent maintenance repairs or adjustments by all qualified contractors.



- c. Manufacturers of the apparatus shall provide technical support and parts replacements for their equipment and component systems for a minimum of twenty (20) years, and issue such guarantee of support to the purchaser with written certification naming the final Owner of their product(s) to ensure the apparatus or systems remain maintainable regardless of who may be selected for future service.
8. All equipment provided shall be factory and field tested with a history of design reliability and net-useful life established.
  - a. Contractor must be able to demonstrate the apparatus to be installed has been used successfully in a substantially similar manner under comparable conditions.
  - b. If the apparatus proposed differs substantially in construction, material composition, design, size, capacity, duty or other such rating from the equipment previously used for the same purpose by the manufacturer, the Government may reject the apparatus or require the vendor test and demonstrate the adequacy and suitability for this particular situation. Any necessary tests shall be performed at the sole expense of the Contractor with no prior guarantee of acceptance after the testing procedure.
9. The Contractor shall not use as part of the permanent equipment any experimental devices, proprietary design, components; construction of materials which have not been fully tried out in at least substantially similar or under comparable service, except as may be especially approved by the Government. If any important equipment or devices to be used on this installation differ substantially in construction, materials, design, size, capacity or duty from corresponding items previously used for the same purpose by the manufacturer, they shall pass such tests as the Government may require to fully show their adequacy and suitability. These tests shall be in addition to tests herein specified and shall be made at the expense of the Contractor.
10. Certain design limitations, tests, etc., are herein specified as a partial check of the adequacy of design, construction and materials used. These requirements do not cover all features necessary to ensure satisfactory and approved operation, etc., of the equipment.
11. It is understood, the entire system shall be designed, fabricated, modified and/or upgraded in full compliance

with applicable local laws and code standards and government requirements. The absence of a particular item or requirement shall not relieve the Contractor of the full and sole responsibility for such equipment, features and/or procedures.

12. The Specifications are intended to include all engineering, material, labor, testing, and inspections needed to achieve work specified by the Contract Documents. Inasmuch as it is understood that any incidental work necessary to complete the project is also covered by the Specifications, bidders are cautioned to familiarize themselves with the existing job site conditions. Additional charges for material or labor shall not be permitted subsequent to execution of the Contract.
13. Bidders must report discrepancies or ambiguities occurring in the Specifications to the Government for resolution prior to the bidding deadline, otherwise the Specifications shall be deemed acceptable in their existing form.

C. Abbreviations and Symbols

1. The following abbreviations, Associations, Institutions, and Societies may appear in the Project Manual or Contract Documents:

AHJ	Authority Having Jurisdiction
AIA	American Institute of Owners
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
FAR	Federal Acquisition Regulations
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Agency
OSHA	Occupational Safety and Health Act
VAMC	Veterans Administration Medical Center
PDF	Portable Document Format
CAD	Computer Aided Design

D. Codes and Ordinances / Regulatory Agencies

1. Work specified by the Contract Documents shall be performed in compliance with applicable Federal ordinances in effect at the time of Contract execution. Elevator installation shall meet the requirements of the latest editions published and adopted by the United States Department of Veterans Affairs on the date contract is signed.

Regulations of the Authority Having Jurisdiction shall be fulfilled by the Contractor and Subcontractors. The entire installation, when completed, shall conform with all applicable regulations set forth in the latest editions of:

- a. Site Safety Manual (Construction and Maintenance Documents) including site safety manual acknowledgement and verification requirements.
- b. Local and/or State laws applicable for logistical area of project work.
- c. Building Code applicable to the AHJ.
- d. Elevator Code applicable to the AHJ.
- e. Safety Code for Elevators and Escalators, ASME A17.1 and all supplements as modified and adopted by the AHJ.
- f. Safety Code for Elevators and Escalators, A17.1S supplement to A17.1 as modified and adopted by the AHJ for Machine Room Less installations (MRL).
- g. Guide for Inspection of Elevators, Escalators, and Moving Walks, ASME A17.2.
- h. Safety Code for Existing Elevators and Escalators, ASME A17.3 as modified and adopted by the AHJ.
- i. Guide for emergency evacuation of passengers from elevators, ASME A17.4.
- j. National Electrical Code (ANSI/NFPA 70).
- k. American With Disabilities Act - Accessibility Guidelines for Building and Facilities and/or A117.1 Accessibility as may be applicable to the AHJ.
- l. ASME A17.5/CSA-B44.1 - Elevator and escalator electrical equipment.
- m. VAMC Standards.
- n. VA Barrier Free Design Guide PG\_18\_13
- o. International Building Code (IBC)
- p. National Fire Protection Association:
  - 1) NFPA 13-10: Standard for the installation of Sprinkler Systems
  - 2) NFPA 70-11: National Electrical Code
  - 3) NFPA 72-10: National Fire Alarm and Signaling Code
  - 4) NFPA 101-09: Life Safety Code
  - 5) NFPA 252-08: Fire Test of Door Assemblies
- q. American Society for Testing and Materials (ASTM):
  - 1) A1008/A1008M-10, Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength
  - 2) Low Alloy and High Strength Low-Alloy with Improved Farability

- 3) E1042-02(R2008), Acoustically Absorptive Materials Applied by Trowel or Spray
- r. Society of Automotive Engineers, Inc. (SAE)
- 1) J517-10, Hydraulic Hose, Standard
- s. Gauges:
- 1) For Sheet and Plate: U.S. Standard (USS)
  - 2) For Wire: American Wire Gauge (AWG)
- t. American Welding Society (AWS):
- 1) D1.1-10, Structured Welding Code Steel
- u. National Electrical Manufacturers Association (NEMA):
- 1) LD-3-05, High Pressure Decorative Laminates
- v. Underwriter's Laboratories (UL):
- 1) 486A-03, Safety Wire Connectors for Copper Conductors
  - 2) 797-07, Safety Electrical Metallic Tubing
- w. Institute of Electrical and Electronic Engineers (IEEE)
- x. Regulatory Standards: Uniform Federal Accessibility Standards
- y. Federal Specifications (Fed. Spec.):
- 1) J-C-30B, Cable and Wire, Electrical (Power, Fixed Installation)
  - 2) J-C-580 Cord, Flexible, and Wire, Fixture
  - 3) W-S-610 Splice Connectors
  - 2) W-C-596F, Connector, Plug, Electrical; Connector, Receptacle, Electrical
  - 3) W-F-406E, Fittings for Cable, Power, Electrical and Conduit, Metal, Flexible
  - 4) HH-I-558C, Insulation, Blankets, Thermal (Mineral Fiber, Industrial Type)
  - 5) W-F-408E, Fittings for Conduit, Metal, Rigid (Thick Wall and Thin Wall [EMT] Type)
  - 6) RR-W-410, Wire Rope and Strand
  - 7) TT-E-489J, Enamel, Alkyd, Gloss, Low VOC Content
  - 8) QQ-S-766, Steel, Stainless and Heat Resisting, Alloys, Plate, Sheet and Strip

2. The Contractor shall advise the Owner's Representative of pending code changes that could be applicable to this project and provide quotations for compliance with related costs.

E. Definitions

1. Defective Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Definitions in ASME A17.1 as amended or modified by the AHJ apply to work of this Section.

1.2 SUBMITTALS

A. Submittals

1. Submit in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
2. Prior to beginning the work, the Contractor shall submit and have approved copies of layout drawings, shop drawings and standard cuts. These items shall include:
  - a. A plan view of the hoistway and machine room. Plans shall include a 1/4" = 1'-0" scaled drawing showing room layout including locations of the machine, governor, controller, resistor pack disconnect, utilization equipment, HVAC equipment, etc.
  - b. Plans need to show clearance dimensions and machine control room door swing direction. Plans shall include a 1/4" = 1'-0" scaled elevation drawing of elevator equipment
  - c. Include a 1/8" = 1'-0" architectural plan showing the location of the elevator machine control space and the hoist way. Plan shall show room names, location of space in the building, and corridors.
  - d. Equipment clearances will need to comply with ASME 17.1, Section 2.7 s-2005 and 2011 National Electrical Code, Article 110 and Article 620.
  - e. Elevation and placement of equipment in the pit, including reaction of supports and buffer impact loads.
  - f. Top and bottom clearances of overtravel of car and counterweigh
  - g. Drawings of hoistway entrances and doors showing details of construction and method of fastening to the structural members of the building.

- 1) If drywall construction is used to enclose hoistway, submit details of interface fastenings between entrance frames and drywall.
- h. Sill details including sill support
3. Approved filing and submittal requirements must be completed before equipment and related materials are ordered.
4. Copies of Department of Buildings' permits and/or governing authority's documents will be posted at the job site with copies issued to the Owner's Agent, Owner's Representative and Government.
5. Samples of wood, metal, plastic, paint or other architectural finish material applicable to this project shall be submitted for approval by the Owner's designee. Samples shall include the following:
  - a. One (1) each, of stainless steel, 75 mm x 125 mm (3 in. x 5 in.)
  - b. One (1) each, of baked enamel, 75 mm x 125 mm (3 in. x 5 in.)
  - c. One (1) each, of color vinyl floor tile
  - d. One (1) each, of protection pads, 75 mm x 125 mm (3 in. x 5 in.) if used
  - e. One (1) each, car and hoistway Braille plate sample
  - f. One (1) each, car and hall button sample
  - g. One (1) each, car and hall lantern/position indicator sample
  - h. One (1) each, wall and ceiling material finish sample
  - i. One (1) each, car lighting sample
  - j. No other samples of materials specified shall be submitted unless specifically requested after submission of manufacturer's name.
6. Each submittal will indicate the specification section, page, and standard that the product complies with.
7. Name of manufacturer, type or style designation, and applicable data of the following equipment shall be shown on the elevator layouts:
  - a. Machine Motor, HP and RPM ratings, Voltage, Starting and Full Load Ampere, and Number of Phases.
  - b. Controller
  - c. Starters and Overload Current Protection Devices.
  - d. Car Safety Device; maximum and minimum rated loads and rated speeds.
  - e. Electric Door Operator; HP and RPM ratings, Voltage and Ampere rating of motor, door times.

- f. Hoistway Door Interlocks.
- g. Car and Counterweight Buffers; maximum and minimum rated loads, maximum rated striking speed and stroke.
- h. Cab Ventilation Unit; HP rating and CFM rating.
- i. Complete construction drawings of elevator car enclosure, showing dimensioned details of construction, fastenings to platform, car lighting, ventilation, ceiling framing, top exits, and location of car equipment.
- j. Dimensioned drawings showing details of:
  - 1) All signal and operating fixtures.
  - 2) Car and counterweight roller guides.
  - 3) Hoistway door tracks, hangers, and sills.
  - 4) Door operator, infrared curtain units.
  - 5) Drawings showing details of controllers and supervisory panels.
- k. Cut sheets and drawings showing details of controllers and supervisory panels.
- l. Furnish certificates as required under: Paragraph "QUALIFICATIONS".

B. Measurements and Drawings

- 1. Drawings or measurements included with the bidding material shall be for the convenience of the bidders only and full responsibility for detailed dimensions lies with the Contractor.
- 2. In the execution of the work on the job, the Contractor shall verify all dimensions with the actual conditions.
- 3. Where the work of the Elevator Contractor is to join other trades, the shop drawings shall show the actual dimensions and the method of joining the work of the various trades.
- 4. The successful bidder will submit the stamped structural engineering data for approval to the Government and ownership group, prior to any work being performed on any building structural material.

C. Changes in Scope of Work

- 1. The Owner may at any time make changes in the specifications, plans and drawings, omit work, and require additional work to be performed by the Contractor.
  - a. Each such addition or deletion to the Contract shall require the Owner and the Contractor to negotiate a mutually acceptable adjustment in the contract price, and, for the Contractor to issue a change order describing the nature of the change and the amount of

price adjustment. All changes will be governed by the FAR.

- b. The Contractor shall make no additions, changes, alterations or omissions or perform extra work except on written authorization of the Owner.
- c. Each change order shall be executed by the Contractor, Owner, and the Government.

D. Keys

- 1. Upon the initial acceptance of work specified by the Contract Documents on each unit, the Contractor shall deliver to the Locksmith, six (6) keys for each general key-operated device that is provided under these specifications in accordance with ASME A17.1, Part 8 standards as may be adopted and modified by the AHJ.
- 2. All other keying of access or operation of equipment shall be provided in accordance with ASME A17.1 Part 8 as may be adopted and modified by the AHJ.
- 3. All key switches associated with the Fireman's Service features shall be keyed to the ASME A17.1-2010 requirements, including the use of FEOK1 keys in all applicable Firemen's Service key-switch assemblies.
- 4. Where key-operated switches are furnished in conjunction with any component of this elevator installation, the cylinders shall be keyed to use an IC core that is compatible with Corbin Russwin Large Format Interchangeable Core, 62A1, 6 - Pin Keyway.

E. Diagnostic Tools

- 1. Prior to seeking final acceptance of the project, the Contractor shall deliver to the Owner any specialized tools required to perform diagnostic evaluations, adjustments, and/or programming changes on any microprocessor-based control equipment installed by the Contractor. All such tools shall become the property of the Owner.
  - a. Owner's diagnostic tools shall be configured to perform all levels of diagnostics, systems adjustment and software program changes which are available to the Contractor.
  - b. Owner's diagnostic tools that require periodic re-calibration and/or re-initiation shall be performed by the Contractor at no additional cost to the Owner for a period equal to the term of the maintenance agreement from the date of final acceptance of the project.
  - c. The Contractor shall provide a temporary replacement, at no additional cost to the Owner, during those intervals in which the Owner might find it necessary to



surrender a diagnostic tool for re-calibration, re-initiation or repair.

2. Contractor shall deliver to the Owner, printed instructions, access codes, passwords or other proprietary information necessary to interface with the microprocessor-control equipment.

F. Wiring Diagrams, Operating Manuals and Maintenance Data

1. Provide three complete sets of paper and one electronic set field wiring and straight line wiring diagrams showing all electrical circuits in the hoistway, machine room and fixtures. Install one set coated with an approved plastic sealer and mounted in the elevator machine room as directed by the Resident Engineer.
2. In the event field modifications are necessary during installation, diagrams shall be revised to include all corrections made prior to and during the final inspection. Corrected diagrams shall be delivered to the Resident Engineer within thirty (30) days of final acceptance.
3. The manuals shall also be submitted in electronic format on non-volatile DVD media, incorporating raw 'CAD' and Acrobat 'PDF' file formats.
4. Manuals, as well as electronic copies, shall contain the following:
  - a. Step-by-step adjusting, programming and troubleshooting procedures that pertain to the solid-state microprocessor-control and motor drive equipment.
  - b. Passwords or identification codes required to gain access to each software program in order to perform diagnostics or program changes.
  - c. A composite listing of the individual settings chosen for variable software parameters stored in the software programs of both the motion and dispatch controllers.
5. Method of control and operation. Including detailed description of system logic.
6. Provide four (4) sets three (3) hard copies and one digital of "AS INSTALLED" straight-line wiring diagrams in both hard and electronic format in accordance with the following requirements:
  - a. Displaying name and symbol of each relay, switch or other electrical component utilized including identification of each wiring terminal.
  - b. Electrical circuits depicted shall include all those which are hard wired in both the machine room and hoistway.

- c. Supplemental wiring changes performed in the field shall be incorporated into the diagrams in order to accurately replicate the completed installation.
7. Furnish four (4) three (3) bound and one (1) digital set of instructions and recommendations for maintenance, with special reference to lubrication and lubricants. All manuals shall also be submitted in electronic format on non-volatile DVD media, incorporating raw 'CAD' and Acrobat 'PDF' file formats.
8. Changes made during the warranty period shall be noted on the drawings in adequate time to have the finalized drawings reproduced for mounting in the machine room no later than six months prior to the expiration of the warranty period.

G. Training Instruction of VA Personnel

1. Provide competent instruction to VA personnel regarding the operation of equipment and accessories installed under this contract, for a period equal to one eight hour day. Instruction shall commence after completion of all work and at the time and place directed by the Resident Engineer.
2. Written instructions in triplicate relative to care, adjustments and operation of all equipment and accessories shall be furnished and delivered to the Resident Engineer in independently bound folders. DVD recordings will also be acceptable. Written instructions shall include correct and legible wiring diagrams, nomenclature sheet of all electrical apparatus including location of each device, complete and comprehensive sequence of operation, complete replacement parts list of with descriptive literature, and identification and diagrams of equipment and parts. Information shall also include electrical operation characteristics of all circuits, relays, timers, electronic devices, and related characteristics for all rotating equipment.
3. Provide supplementary instruction for any new equipment that may become necessary because of changes, modifications or replacement of equipment or operation under requirements of paragraph entitled "Warranty of Construction".

1.3 QUALITY ASSURANCE

A. Materials and Quality of Work

1. All materials are to be new and of the best quality of the kind specified.

2. Installation of such materials shall be accomplished in a neat manner and be of the highest quality.
  - a. Should the Contractor receive written notification from the Owner stating the presence of inferior, improper, or unsound materials or quality of installation, the Contractor shall, within twenty-four (24) hours, remove such work or materials and make good all other work or materials damaged.
  - b. Should the Owner permit said work or materials to remain, the Owner shall be allowed the difference in value or shall, at its election, have the right to have said work or materials repaired or replaced as well as the damage caused thereby, at the expense of the Contractor, at any time within one (1) year after the completion of the work; and neither payments made to the Contractor, nor any other acts of the Owner shall be construed as evidence of acceptance and waiver.

B. Mechanical Design Requirements (General)

1. The following typical requirements shall apply to all parts of the work where applicable and are supplementary to other requirements noted under the respective headings.
  - a. All bearings, pivots, guides, guide shoes, gearing, door hanger sheaves, door hanger tracks and similar elements subject to friction or rolling wear in the entire elevator installation shall be accurately and smoothly finished and shall be arranged and equipped for adequate and convenient lubrication. Means shall be provided for flushing and draining the larger bearings and gear case. All oiling holes shall have dustproof, self-cleaning caps.
  - b. Bearings of governor and governor sheaves and important supporting bearings of other parts in motion when the elevator is traveling shall, unless otherwise specified or approved, be of ball or roller bearing type.
  - c. Bearings for brake levers and similar uses where the amount of movement under load is light and the wear negligible may be unlined.
  - d. All plain bearings shall be liberally sized in accordance with the best commercial elevator usages which have proved entirely satisfactory on heavy-duty installations.
  - e. Bearings of motors shall be arranged and equipped for adequate automatic lubrication. Ring or chain oilers, spring-fed grease cups and equivalent devices properly used in accordance with the best commercial elevator practice will be acceptable. Approved means shall be

provided for visibly checking the amount of lubricant contained and for flushing and draining. Means shall also be provided for preventing leakage of lubricant when the reservoirs or grease cups are filled to proper levels.

- f. Ball and roller bearings shall be of liberal size and of a type and make which have been extensively and successfully used on other similar, heavy-duty elevator installations. They shall be fully enclosed. Loading, lubrication, support and all other conditions of use shall be in accordance with the recommendations of the bearing manufacturer based on previous extensive and satisfactory elevator usage.
- g. All armature spiders and similar items intended to rotate with their shafts shall be keyed and/or firm press or shrunk fit on the shafts. Set screw fastening will be permitted only for minor items not subject to hoisting loads and where means for field adjustment is required.
- h. All bolts used to connect moving parts, bolts carrying hoisting stresses and all other bolts, except guide rail bolts, subject to vibration or shock shall be fitted with adequate means to prevent loosening of the nuts and bolts. Bolts transmitting important shearing stresses between machine parts shall have tight body fit in drilling holes.
- i. All machine work, assembling and installing shall be done by skilled and experienced mechanics using first-class, modern equipment and tools. All work shall be thoroughly high grade in every respect. All parts will be manufactured to high precision standards so that wearing parts will be readily interchangeable with stock repair parts with a minimum of field fitting.
- j. All bearing and sliding surfaces of shafts, pins, bearings, bushings, guides, etc., shall be smoothly and accurately finished. They shall be assembled and installed in accurate alignment and with working clearance most suitable for the load, speed, lubrication and other conditions of use.
- k. Structural steel used for supporting and securing equipment and for the construction of car slings, etc., shall conform to the A.S.T.M. specification for Structural Steel for Buildings. Design stresses shall not exceed those specified in the local Building Code.
- l. Castings of motor frames, sheaves, gear casings, etc., shall be of the best quality metallurgically controlled, hard, close grained gray machinery cast iron, free from blow holes, sand holes, or shrinkage cracks, ground to remove overruns, sanded and machined

so as to leave a finish suitable for its particular application. Surfaces of sheaves and brake drums shall be entirely free from defects and shall show a hardness of not less than 220 Brinell.

C. Electrical Design Requirements (General)

1. The following typical requirements shall apply to all parts of the work and are supplementary to other requirements noted under the respective headings.
  - a. The design and construction of the motors shall conform to the requirements of these specifications and to the ASME Standards for Rotating Electrical Machinery with revisions issued to the first day when the work of this Contract was advertised.
    - 1) Motors shall operate successfully under all loads and speeds and during acceleration and deceleration.
    - 2) Motors shall be designed for quiet operation without excessive heat.
    - 3) Insulation on motor coils and windings and on all insulated switch, relay, brake and other coils shall conform to the requirements for Class "H" insulation, as defined in ASME Standards for Rotating Electrical Machinery. All motors shall be impregnated twice.
    - 4) Switches, relays, etc., on controller, starter and signal panels and similar items on other parts of the equipment shall be the latest improved type for the condition of use. They shall function properly in full accordance with the requirements of the machines controlled and with the specified operating requirements of the elevator. Any of these parts showing wear or other injurious effects during the guarantee period to the extent that abnormal maintenance is required or indicated shall be replaced with proper and adequate parts by the Contractor.
    - 5) Contacts in elevator motor circuits which are intended to be opened by governors or other safety devices shall be copper to carbon or other approved non-fusing type.
    - 6) Where required, controllers and other component parts of the installation shall be labeled in accordance with the latest codes and standards as adopted and/or otherwise modified by the AHJ.

- 7) Electrical equipment, motors, controllers, etc., installed under this contract shall have necessary CSA/US or UL/US listing. Equipment shall be labeled or tagged accordingly.

D. Materials, Painting and Finishes

1. Two (2) coats of rust inhibiting machinery enamel shall be applied to exposed ferrous metal surfaces in the pit that do not have a galvanized, anodized, baked enamel, or special architectural finishes. All retained pit equipment that contains surface rust will be wire wheel brushed, cleaned, and primed with a rust inhibiting primer, prior to coating with two (2) coats of rust-inhibiting machinery enamel.
2. Two (2) coats of rust-inhibiting enamel paint to the machinery located within the machine room and secondary level (where applicable) as well as to the machine room and pit floors.
3. Architectural metal surfaces of bronze or similar non-ferrous materials which are specified to be refinished, re-clad and/or provided new, shall be sufficiently clear coated so as to resist tarnishing during normal usage for a period of not less than twelve (12) months after final acceptance by the Owner.
4. Identify all equipment including buffers, crosshead, safety plank, machine, controller, drive, governor, disconnect switch, etc., by 4" high numerals which shall contrast with the background to which it is applied. The identification shall be either decalomania or stencil type.
5. Paint or provide decal-type floor designation not less than four (4) inches high on hoistway doors (hoistway side), fascias and/or walls as required by Code at intervals not exceeding 7'-0". The color of paint used shall contrast with the color of the surface to which it is applied.
6. Upon completion of installation and prior to final inspection, all equipment shall be thoroughly cleaned of grease, oil, cement, plaster and other debris. All equipment, except that otherwise specified as to architectural finish, shall then be given two coats of paint of approved color, conforming to manufacturer's standard. Two (2) coats of rust-inhibiting machinery enamel shall be applied to all surfaces of the bottom of the car platform, including bolster channels, stringers, and related hardware.
7. Hoistway door panels shall be given equivalent rust-resistant treatment and a factory finish of one coat of baked-on primer and one factory finish coat of baked-on enamel.

8. Fascia plates, top and bottom shear guards, dust covers, hanger covers, and other metalwork, including built in or hidden work and structural metal, (except stainless steel entrance frames and surfaces to receive baked enamel finish) shall be given one approved prime coat in the shop, and one field coat of paint of approved color.
9. If painting of the equipment becomes disruptive to the staff/patients, arrangements shall be made for the painting to occur after hours which are approved by the Owner. Any overtime fees to do the painting shall be included in the base bid amount.

E. General

1. Cold-rolled Sheet Steel Sections: ASTM A1008, commercial steel, Type "B".
  - a. Shop Prime: Factory-applied baked on coat of mineral filler and primer.
  - b. Finish Paint: Two (2) coats of low sheen baked enamel, color as selected by the Owner.
  - c. Steel Equipment: Two (2) coats of manufacturer's standard rust-inhibiting paint.
2. Steel Supports and Reinforcement: ASTM A36
3. Stainless Steel Bars and Shapes: ASTM A276
4. Stainless Steel Tubes: ASTM A269
5. Aluminum Extrusions: ASTM B221
6. Structural Tubing: ASTM A500
7. Bolts, Nuts and Washers: ASTM A325 and A490.
8. Clear Tempered Glass: ASTM C1048

F. Handicapped Requirements (ADAAG)

1. Locate the alarm button and emergency stop switch at 35", and floor and control buttons not more than 48" above the finished floor. The alarm button shall illuminate when pressed for visual acknowledgement to user.
2. Provide raised markings in the panel to the left of the car call and other control buttons. Letters and numbers shall be a minimum of 5/8" and raised .03" and shall be in contrasting color to the call buttons and cover plate.
3. The centerline of new hall push button shall be 42" above the finished floor.
4. The hall arrival lanterns or cab direction lantern provided shall sound once for the "up" direction and twice for the "down" direction. Design and locate fixtures per Federal standards.
5. Provide floor designations at each entrance on both sides of jamb at a height of 60" above the floor. Designations

shall be 2" high, raised .03" on a contrasting color background as selected by the Owner. Any existing Braille plates will be removed and the entrance refinished to like new conditions.

- a. Use cast metal plates and polished numbers mechanically secured with tamper-proof hardware.
  - b. Designations shall be 2" high, raised .03" on a contrasting color background as selected by the Owner. Surface mounted plates are not acceptable.
6. Provide an audible signal within the elevator to tell passenger that the car is stopping or passing a floor served by the elevator.
  7. Where elevators operate at a speed greater than 200 fpm, provide a verbal annunciator to announce the floor at which the elevator is stopping. Provide signal control timing for passenger entry/exit transitions per Federal standards.
  8. Ensure sill-to-sill running clearances do not exceed 1-1/4" at all landings served.
  9. Provide visual call acknowledgment signal for car emergency intercommunication device.
  10. Provide visual signage and indicators for cars identified as code blue medical emergency requirements.

G. Qualifications

1. Approval by the Contracting Officer is required for products and services of proposed manufacturers, suppliers and installers and shall be contingent upon submission of certificates by the Contractor stating the following:
  - a. Elevator contractor is currently and regularly engaged in the installation of elevator equipment as one of his principal products.
  - b. Elevator contractor shall have three years of successful experience, trained supervisory personnel, and facilities to install elevator equipment specified herein.
  - c. Elevator Mechanic (Installer) shall have passed a Mechanic Examination approved by the U.S. Department of Labor and have technical qualifications of at least five years of experience in the elevator industry or 10,000 hours of field experience working in the elevator industry with technical update training. Apprentices shall be actively pursuing Certified Elevator Mechanic status. Certification shall be submitted for all workers employed in this capacity.



2. Approval of Elevator Contractor's equipment will be contingent upon their identifying an elevator maintenance service provider that shall render services meeting the requirements of Section 14.99.00 Elevator Maintenance Requirements included with this document, notification, together with certification that the quantity and quality of replacement parts stock is sufficient to warranty continued operation of the elevator installation.
3. Approval will not be given to elevator contractors and manufacturers who have established on prior projects, either government, municipal, or commercial, a record for unsatisfactory elevator installations, have failed to complete awarded contracts within the contract period, and do not have the requisite record of satisfactorily performing elevator installations of similar type and magnitude.
4. Equipment within a group of electric traction elevators shall be the product of the same manufacturer.
5. The Contractor shall provide and install safety devices that have been subjected to tests witnessed and certified by an independent professional testing laboratory that is not a subsidiary of the firm that manufactures supplies or installs the equipment.
6. Welding at the project site shall be made by welders and welding operators who have previously qualified by test as prescribed in American Welding Society Publications AWS D1.1 to perform the type of work required. Certificates shall be submitted for all workers employed in this capacity. A welding or hot work permit is required for each day and shall be obtained from the VAMC safety department. Request permit one day in advance.
7. Electrical work shall be performed by a Licensed Master Electrician and Licensed Journeymen Electricians as requirements by NEC. Certificates shall be submitted for all workers employed in this capacity.

1.4 DELIVERY / STORAGE / HANDLING / COORDINATION

A. Delivery and Storage of Material and Tools

1. Comply with the requirements of Division 01.
2. Delivery, Storage and Handling:
  - a. Deliver materials to the site ready for use in the accepted manufacturer's original and unopened containers and packaging, bearing labels as to type of material, brand name and manufacturer's name.

Delivered materials shall be identical to accepted samples.

- b. Store materials under cover in a dry and clean location, off the ground.
  - c. Remove delivered materials which are damaged or otherwise not suitable for installation from the job site and replace with acceptable materials.
3. The Owner shall bear no responsibility for the materials, equipment or tools of the Contractor and shall not be liable for any loss thereof or damage thereto.
  4. The Contractor shall confine storage of materials on the job site to the limits and locations designated by the Owner and shall not unnecessarily encumber the premises or overload any portion with materials to a greater extent than the structural design load of the Facility.
  5. The transportation of material from the storage site to the project will be the responsibility of the elevator contractor.
  6. Any requirements for on or offsite storage will be the responsibility of the elevator contractor. Onsite storage costs required for storage containers will be the responsibility of the elevator contractor.

B. Work With Other Trades / Coordination

1. Coordinate installation of sleeves, block outs, equipment with integral anchors, and other items that are embedded in concrete or masonry for the applicable equipment. Furnish templates, sleeves, equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
2. Coordinate sequence of installation with other work to avoid delaying the Work.
3. Coordinate locations and dimensions of other work relating to elevators including pit ladders, access for hoistway venting including heat and fire smoke sensor placement, sumps in pits; entrance sub sills; beam pocket placement verification, machine beams; and electrical service, electrical outlets, lights, and switches in pits and machine rooms, overhead sheave rooms and hoistways.
4. Coordinate running of the car top access for all contractors for related hoistway work during regular and overtime hours. Costs for running the elevator for contractors will be part of the base bid pricing.
5. Coordinate sequence of installation for group features including dispatching, emergency power, Firemen's service operation, testing, and inspections with the ownership group and or owner's representative.

C. Removal of Rubbish and Existing Equipment

1. On a scheduled basis, the Contractor shall remove from the job site all rubbish generated in performing work specified in the Contract Documents.
2. Any component of the existing elevator plant that is not reused under the scope of work specified in the Contract Documents shall become property of the Contractor and, as such, shall be removed from the premises at the Contractor's sole expense.
3. The Contractor agrees to dispose of the aforementioned equipment and rubbish in accordance with any and all applicable Federal, State, ICRA, and municipal environmental regulations, and further accepts all liability that may result from handling and/or disposing of said material.

D. Protection of Work and Property

1. The Contractor shall continuously maintain adequate protection of all their work from damage and shall protect the Owner's property from injury or loss arising out of this contract.
2. The Contractor shall make good any such damages, injury or loss, except such as may be directly caused by agents or employees of the Owner.
3. The Contractor shall provide full height, lockable barricades required to protect open hoistways or shafts per OSHA regulations. Such protection shall include any necessary guards or other barricades for employee protections during and after the modernization procedure.
4. See General requirement, Section 01 00 00.

1.5 RELATED WORK

A. Related Work to be included in the Base Bid

1. The following requirements shall be applicable based on prevailing conditions at the site of work and/or mandated modifications for code compliance.
  - a. Submission of Site Safety Manual for Construction and Maintenance Documents, including site safety manual acknowledgement and verification requirements.
  - b. Interface building fire smoke signal, wiring, controls, and telephone in machine room junction box.
  - c. Coordinate all related work by sub-contractors, including car top time for other trades to inspect and

complete required work in the hoistway, machine room, and pits.

- d. All elevator access car top time needed for other contractors to complete related work in the elevator shafts, secondary levels, and pits will be included in the base bid pricing. This time includes as needed elevator personnel to run the elevator for other contractors to access the elevator shafts, secondary levels, and pits as needed.
- e. Interfacing materials and required integration time between the elevator contractor and the card reader contractor for full installation capabilities a card reader system for all elevators. The card reader is to be provided by this contractor and interface with the existing VA system.
- f. Provide any necessary cutting or patching for the installation of the new machines.
- g. The elevator contractor is responsible for all rigging, hoisting, crane work, and crane permits, as required, to remove existing equipment from the building and install new equipment. All crane picks / lifts will require a minimum of one week notice in advance.
- h. Provide emergency communication means from the machine room to the cab as required by ASME A17.1 or local code. Telephone lines to the machine room for such systems shall be reused or provided by this contractor.
- i. Where the pit extends more than 3 feet below the sill of the pit access door, provide a permanent fixed metal ladder.
  - 1) Ladder shall extend no less than 48" above the sill of the access door. Handgrips shall extend from the ladder to a point no less than 48" above the sill of the access door where the ladder does not comply.
  - 2) The rungs shall be a minimum of 12" wide. Where prevailing conditions prevent a 12" wide rung, the rung may be reduced to no less than 9".
  - 3) The rungs shall be spaced 12" on center.
  - 4) A clear distance of no less than 4-½" from the centerline of the rungs and handgrips to the nearest permanent object in back of the ladder shall be provided.
- j. Provide the following signage, plates and tags:
  - 1) Provide access doors to each machinery space with signs that read "ELEVATOR MACHINE ROOM". Letters

- shall be not less than 2" high. All signage will require prior approval before installed.
- 2) Provide all required manufacturer data plates and installation-specific tags and signs of the types and styles containing information as required by applicable Codes and Standards as adopted and/or modified by the AHJ.
  - 3) Signage to and on the machine room doors as required by applicable codes.
  - 4) Provide elevator identification numbers at or near the door frames of each elevator in the main fire recall lobbies. Size of numbering and style shall be contingent upon local code requirements or owner's standards.
- k. Provide a standard railing conforming to Code on the outside perimeter of the car top on all sides where the perpendicular distance between the edges of the car top and the adjacent hoistway enclosure exceeds 300 mm (12 in.) horizontal clearance or as otherwise required by the Authority Having Jurisdiction.
- l. All costs associated with acceptance testing, including all overtime, inspector's fees and re-inspection costs shall be included in the base bid.
- m. If extenuating circumstances (i.e., separating cars, testing, inspection, etc.) require that multiple cars be removed from service simultaneously, the work shall be performed outside of the normal business hours at an agreed-upon time. A minimum of five (5) days advance written notice shall be given to the Owner and Elevator Consultant detailing the reason for needing to remove multiple elevators from service simultaneously along with the estimated down time. The request shall be subject to review and approval by the Owner and Elevator Consultant and all work and associated expenses shall be included as part of the base bid pricing.
- n. Provide the resources and time required to coordinate work and scheduling requirements between all trades to perform the related work required as part of the elevator modernization project.
- o. Provide all necessary work to provide for a complete, legal, code compliant installation.
- p. Subsequent to contract execution, the Contractor shall perform the following procedures and engineering tasks relative to balance loading of system and cab work included under base specification requirements and alternative/optional upgrades:

- 1) Perform balance load testing to determine existing conditions and requirements applicable to new/modified equipment.
  - 2) Provide data for Purchaser and/or their agents to evaluate any limitations that may be placed on design/finish options due to prevailing conditions or total suspended loading (weigh all cars).
  - 3) All costs to perform the above mentioned balance loading work is to be included in the base bid amount.
- q. Install separation wall(s) between HVAC and mechanical related equipment from elevator equipment in all machine rooms.
- r. Provide code compliant panning or isolation of roof drains in machine room.
- s. Provide code compliant access requirements to get the elevator equipment into the machine rooms, pits, and hoistways. Any modifications to the building will require prior approval with ownership.
- t. Modify and/or replace step access to machine rooms to meet code compliance for rise, step height, and landing requirements. Submittal drawings will be required prior to any modifications of the existing or new equipment.
- u. Provide machinery spaces of the secondary level directly below the machine room with permanent lighting fixtures fitted with protective guards and a duplex GFI receptacle. Illumination shall be no less than 19 foot-candles at floor level. A light control switch must be provided immediately adjacent to the secondary level entrance door/ladder in accordance with code.
- v. Reuse and modify the existing power supplies to utilize the building power for the new controllers. Provide grounding wire for the system, including all disconnects feeders, and transformers, in accordance with NEC. Install locking provisions for circuit breakers as per code. If existing disconnects are not capable of being locked in the open (OFF) position, new mainline and/or auxiliary disconnect switches shall be provided. Any relocation of mainline disconnect switches (new or existing) shall be included.
- w. Install a new disconnecting means for control systems on the upper deck of the machine room that is not within direct sight of the mainline disconnects.
- x. Provide auxiliary power feeds with required distribution load center (circuit breaker panel) for intercommunication, CCTV systems, and cab lighting or

other specialty devices existing or to be provided by the Elevator Contractor.

- 1) Voltage shall be 110 VAC with one 15, Amp circuit breaker or fuse for lighting of each individual elevator car enclosure.
  - 2) Circuit breakers and/or fused disconnects shall be lockable in the "OFF" position in accordance with applicable code.
- y. All lighting fixtures and related switches in the elevator machine room, hoistway, secondary levels, and pits will utilize LED fixtures and lighting.
- z. Provide all wiring, piping, access panels, and labor as required for the installation of the card readers (car and hall), video cameras, and voice communication system (as applicable), including all fixtures, network switches, lobby, security desk, fire command room, remote panels, and EMS systems. The wiring can include Cat 5 and/or fiber optic, as required. Cameras and card readers to be supplied as part of this contract. These must be compatible with the existing security and CCTV systems.
- aa. Installation of new permanent LED lighting fixtures with protective guards and 110 volt duplex GFI receptacles inside the machine rooms and secondary levels. The illumination shall be no less than 30 foot-candles at floor level. A light control switch shall be provided immediately adjacent to the machine room entrance door. Provide necessary receptacles as required by Elevator Contractor to supply power to auxiliary elevator equipment and/or remotely located monitors.
- bb. The top surface of any setback or projection in the hoistway that measures 2" or more in width shall be beveled at an angle of not less than 75 degrees from horizontal, constructed from prime painted 14 gauge cold-rolled steel and installed so as to conform with ASME A17.1 elevator safety code as modified by, and/or in addition to codes and standards accepted by the AHJ.
- cc. A light control switch shall be provided immediately adjacent to the machine room stairwell entrance door and top of the stairwell, where applicable.
- dd. Provide each elevator pit with a 110 volt GFI duplex receptacle and a permanent LED lighting fixture equipped with protective guard. Illumination shall be no less than 10 foot-candles at pit floor level. A light control switch shall be provided and so positioned as to be readily accessible from the pit

- entrance door and/or ladder from the main lobby. The contractor will provide submittals for the design and layout of the fixtures. The fixture locations will be coordinated with the elevator contractor to ensure it does not hinder the operation of the elevator.
- ee. Provide each machine room and pit with new self-closing, self-locking access door(s) where applicable. Locking means shall be spring-type arranged to permit the doors to be opened from the inside without a key.
  - ff. Provide new as needed fire emergency control interface provisions for automatic recall of the elevator(s) through operation of the fire detection system. Provisions shall be made for alternate designated fire recall landing with connection contingent on Codes recognized by the local governing authority. The interfacing contacts shall be wired to an electrical junction box located inside each elevator machine room for connection to the elevator control systems. Each wire shall be clearly labeled with its control function. Coordinate the type of interface required for the specific elevator control apparatus.
  - gg. All smoke ventilation provisions, including duct work, dampers, fans, fire control interfaces, hoistway vents, and key switches in accordance with local codes, shall be reviewed for proper operation and restored, or new provisions provided as required. Any other existing vents of unknown purpose shall be modified/deleted as per the AHJ and/or VA requirements.
  - hh. Installation of full sprinkler system as required per code, Federal requirements, and VA Standard guidelines for Healthcare facilities. Where sprinkler fire protective systems are provided inside any elevator hoistway, machine room, pit area, or associated machinery space, provisions shall be made for the disconnecting of the main line power supply from the affected elevator prior to activation. This means of disconnect shall be manually reset in accordance with code. Modifications to the existing sprinkler systems to comply with the requirements of the pit, hoistway, and machine room will be included as part of the specifications, including demolition of existing piping in the elevator pits.
  - ii. Installation of emergency power control interface provisions to signal the elevator control apparatus of a transfer from normal (utility) power to the building emergency (generator) power supply. Also, provide additional control interface to give advanced notification to the elevator control apparatus that the power source will transfer from emergency (generator)



power to normal (utility) power. Interfacing contacts shall be wired to an electrical junction box located inside each machine room for connection to the elevator control equipment by the Elevator Contractor. Coordinate the type of interface required for the specific elevator control apparatus with the Elevator Contractor.

- 1) Normal Power/Emergency Power Control Signals consisting of two (2) dry contacts provided by other trades to function as follows:
  - a) One (1) dry contact normally open to make when Normal Power is available. (Logic state of dry contact is to be confirmed by the Manufacturer of the Elevator Control Equipment).
  - b) One (1) dry contact normally open to make when emergency power is available. (Logic state of dry contact is to be confirmed by the Manufacturer of the Elevator Control Equipment).
  
- jj. Modification to existing or installation of new HVAC provisions so as to maintain ambient temperature and humidity levels that are within the range specified by the microprocessor-control equipment manufacturers. Relocate any HVAC and condensation lines currently passing over controllers and power supplies in the machine room.
- kk. Provide a class "ABC" fire extinguisher in electrical machinery and control spaces. Locate the extinguisher in close proximity to the access door.
- ll. Provide necessary patching, repairing and installation of masonry and/or drywall for smooth and legal elevator hoistways.
- mm. Provide required guarding for pipes, conveying gases, vapors, and liquids in machine room, including panning and barriers for overhead applications as allowed by the AHJ.
- nn. Install a new disconnecting means for control systems the machine room that is not within direct sight of the mainline disconnects.
- oo. The removal and proper abandonment of the existing exhaust fan and all applicable piping and wiring currently located in the elevator machine rooms of all Passenger and Service Elevators. Proper HVAC provisions shall meet the requirements for code compliance.

- pp. All phone wiring is to be placed in conduit and permanently installed in a rated enclosure that allows for future expansion. Remove any and all phone conduit, phone wiring and phone controls in elevator machine room and hoistway associated with the operation of the existing elevators and not required to function with the new elevators and associated controls
- qq. Ensure all existing machine room escutcheon floor access panels are fully operational. All broken hinges/ closing/ and locking mechanisms to be inspected for proper operation and repaired as required. All phone wiring is to be placed in conduit and permanently installed in a rated enclosure that allows for future expansion. Remove any and all phone conduit, phone wiring and phone controls in the elevator machine room and hoistway associated with the operation of the existing elevators and not required to function with the new elevators and associated controls.
- rr. Review the existing smoke detector system and provide necessary equipment to comply with the requirements of A17.1, VA Guidelines, and/or the Local Governing Authority. Provide all interface work required. Install all smoke detectors or heat detectors, shunt trip devices and interfaces related to the elevator system, as necessary. All interface work for the installation of the fire panel will need to be coordinated between the elevator contractor and the building facilities, including subcontractors providing the fire alarm panel. Install all smoke detectors or heat detectors, shunt trip devices and interfaces related to the elevator system as necessary.
- ss. Provide each machine room, secondary space and pit with a self-closing, self-locking access door. Locking means shall be spring-type arranged to permit the doors to be opened from the inside without a key
- tt. Provide necessary receptacles as required by Elevator Contractor to supply power to auxiliary elevator equipment, pit sumps, remotely located monitors, and lobby panels.
- uu. Sumps in pits and machine rooms, where provided, shall be covered. The cover shall be level with the pit floor so as not to produce a tripping hazard.
- vv. Provide necessary telephone wiring with connection to local telephone service for remote elevator monitoring and/or two-way voice emergency communications systems.
  - 1) Terminate the telephone wiring in junction boxes or standard phone jack terminals in the machine room.

- 2) Coordinate the quantity and termination method of individual phone connections with the Elevator Contractor.
- 3) Identify each phone line for connection by the Elevator Contractor to the appropriate elevator device(s).
- 4) Telephone wiring, where required by applicable codes, shall be installed in conduit.

## 1.6 WARRANTY / MAINTENANCE SERVICES

### A. Contract Close-Out, Guarantee and Warranties

1. Submit all labor and materials furnished in connection with elevator system and installation to terms of "Warranty of Construction" articles of FAR clause 52.246-21. The one year Warranty shall commence after final inspection, completion of performance test, and upon full acceptance of the installation and run concurrent with the guarantee period of service.
2. During warranty period if a device is not functioning properly in accordance with specification requirements, more maintenance than the contract requires keeping device operational, device shall be removed and a new device meeting all requirements shall be installed as part of work until satisfactory operation of installation is obtained. Period of warranty shall start anew for such parts from date of completion of each new installation performed, in accordance with foregoing requirements.

### B. Maintenance Coverage

1. The following maintenance coverage apply:

#### a. Interim Maintenance

- 1) Provide full protective maintenance services and equipment coverage beginning with the contract award, during the work implementation procedure, and until final acceptance of the finished project.
- 2) Interim full comprehensive maintenance services shall be provided in accordance with Section 14.99.00 Elevator Maintenance Requirements. issued with these documents.
- 3) Costs related to interim maintenance shall be included in the base bid quotation.

#### b. Guaranty Period Services (GPS)

- 1) Furnish complete maintenance and inspection service on entire elevator systems. The modernized elevator systems shall be guaranteed for a period of one year beginning with the completion and acceptance of the last elevator installation by COR. Maintenance work shall be performed by Certified Elevator Mechanics and Apprentices supervised by the company that is providing the guaranteed period of service on the elevator equipment specified herein.
- 2) The warranty period for each elevator being modernized will start on a per-car basis, as each elevator is handed over with final acceptance to the Government.
- 3) The Guarantee period will cover full maintenance services in compliance with Section 14.99.00 Elevator Maintenance Requirements issued with these documents.

**PART 2 - PRODUCTS**

2.1 GENERAL DESCRIPTION - ELEVATORS

A. Hydraulic Passenger Elevator No. 10

1.	Quantity	One (1) / Retain
2.	Type	Passenger / Retain
3.	Capacity (lbs.)	2,500 / Retain
4.	Speed (fpm)	125 / Retain
5.	Number of Landings	Two (2) @ B, 1
6.	Number of Openings	Two (2) @ B, 1
7.	Front Openings	Two (2) @ B, 1
8.	Rear Openings	N/A
9.	Operation	Simplex
10.	Control	New Microprocessor
11.	Fireman's Service	New, as Specified
12.	Machine Room, Secondary, Pit Lighting and GFI	Provide New as required
13.	Machine Type	Submersible
14.	Power Drive	Submersible pump unit
15.	Power Unit	New
16.	Starter	New Solid State
17.	Hydraulic Jack / Cylinder	Retain as specified
18.	Piping	Retain
19.	Scavenger Pump	New
20.	Battery Auto Lowering	New

21.	Car Platform / Sling	Retain
22.	Guide Rails	Retain
23.	Guides	New
24.	Buffers	New
25.	Car Door Size / Type	New / 42" x 7'0" / Center Opening
26.	Hoistway Door Size / Type	New / Same as Car
27.	Master Door Operator	New
28.	Entrance Sills	Retain
29.	Tracks / Hangers / Interlocks / Closers	Retain
30.	Top Emergency Exit	Retain / Modify as required
31.	Keyed Access	New
32.	Pit Ladder	New
33.	Power Supply	Retain / Modify as required
34.	Wiring and Traveling Cables	New
35.	CCTV	New
36.	Security / Card Reader	New
37.	Number of Push Button Risers	One (1)
38.	Hall Operating Fixtures	New
39.	Car Operating Fixtures	New
40.	Communication	New
41.	Door Protective Device	New
42.	Emergency Cab Lighting	New
43.	Car Ventilation	New
44.	Car Enclosure	New
45.	Car Doors	New
46.	Car Flooring	New / Flexible Terrazzo Tile
47.	Car Sill	New / Nickel Silver
48.	Hoistway Doors	New door panels, retain entrance assembly
49.	Elevator Monitoring System	New

## 2.2 MANUFACTURERS

### A. Pre-Approved Equipment Manufacturers

1. The following manufacturers' equipment and materials have been pre-approved for use on this project.
2. Other equipment not specifically mentioned shall be considered for approval on an individual basis.
3. Certain Original Equipment Manufacturers equipment is acceptable unless otherwise specified.
  - a. Controller - GAL (GALaxy), Motion Control Engineering (Elevator Controls Corporation, Elevator Systems, Inc.

- b. Tracks, Hangers, Interlocks and Door Operators - G.A.L.
- c. Fixtures - G.A.L., Adams, EPCO, Monitor, E-Motive USA, C.E. Electronics, Innovation, PTL, MAD, National.
- d. Door Protective Device - Janus, Adams, G.A.L., T.L. Jones, Tri-Tronics.
- e. Cabs and Entrances/Entrance Door Panels - Accurate Elevator Door Corp, EDI/ECI, National Cab & Door, Tyler, Velis, Gunderlin, Premier, Prestige, Regency.
- f. Motors - Imperial Electric, General Electric, Baldor, Reuland Electric.
- g. Guide Rails - AFD Industries, Savera, Monteferro.
- h. Electrical Traveling Cables - Draka, James Monroe
- i. Governor: Hollister Whitney, MCE, approved equal
- j. Buffers: Hollister Whitney, MCE, approved equal
- k. Hydraulic Systems/Components - Canton, ECS Corporation, Elevator Equipment Corporation, Mongrain Vertical Transport (MVT), MEI, Schumacher.
- l. Freight Doors and Systems - Courion, EMS Group, Peelle, Matot.
- m. Guide Shoes/Rollers - ELSCO, G.A.L.
- n. Wire Ropes - Paulsen, Bethlehem, Wayland, Draka, Brugg.
- o. Intercommunications/Telephones - Webb Electronics, K-Tec, Ring, Wurtec, Janus, EMS approved equal.
- p. Cab Vendors: G&R, H&B, approved equal.

## 2.3 CONTROL FEATURES / OPERATION

### A. Control Equipment (New)

- 1. Provide a new non-proprietary microprocessor-based elevator control system.
- 2. The controller vendor shall be able to provide immediate 24/7 tech support.
- 3. Controller parts shall be available for overnight delivery mail, including any parts necessary for maintenance.
- 4. Digital logic shall calculate optimum acceleration, deceleration and velocity patterns for the car to follow during each run.
- 5. Closed-loop distance and velocity feedback shall monitor the actual performance of the elevator car with the desired speed profile.
- 6. System operating software shall be stored in non-volatile, electrically programmable read only memory (EPROM), electrically erasable and programmable read only memory (EEPROM), or flash read only memory (flash ROM).
  - a. Elevator control relays, contactors, switches, capacitors, resistors, fuses, circuit breakers,

overload relays, power supplies, circuit boards, static motor drive units, wiring terminal blocks and related components shall be totally enclosed inside a free-standing metal cabinet with hinged access doors.

- b. Mechanical ventilation of the cabinet shall be provided and shall be adequate to dispose of the full load heat losses without exceeding 40° C (104° F) ambient temperature.
- c. All electrical wiring inside the control equipment cabinet shall be performed in a neat manner with field wiring terminated at stud blocks provided inside the control cabinet.
- d. Each wiring terminal shall be clearly identified according to the nomenclature used on the "as built" wiring diagrams. No more than two (2) field wires may be connected to any single terminal stud.
- e. Spare wires shall be tagged according to their point of termination, bundled, and placed at the bottom of the control equipment cabinet.
- f. Each electrical component within the cabinet shall be permanently identified with symbols, identical to those used on the "as-built" wiring diagrams.
- g. A data plate that indicates the edition of the Code in effect at the time of installation and/or alteration shall be provided in accordance with applicable code and requirements of ASME A17.1 Code. The data plate shall be in plain view and securely attached on the mainline disconnect or on the controller.
- h. Control equipment shall comply with requirements of all applicable Sections of the ASME A17.1 Code as approved and adopted by the AHJ.
- i. A 17" flat-panel LCD monitor shall be provided inside the elevator machine room for diagnostic purposes. The monitor shall be permanently mounted in a cabinet, or in a control cabinet of at least one car of a group. By means of graphic depiction, information available on the screen shall include:
  - 1) An overview of car and corridor calls currently existing within the system.
  - 2) Elevator operating status.
  - 3) Elevator position, direction of travel and velocity.
  - 4) The open/close status of elevator door.
  - 5) The current operational status of each CPU input and output.
  - 6) A sequential history of faults detected within the control system over the previous thirty (30) days.

- j. Provide a microprocessor-based computer system and keyboard in the machine room that allows technicians to place car and hall calls, adjust car/group system parameters, adjust door system parameters, dispatch timers, and other adjustable features that work in conjunction with the aforementioned monitor.

B. Simplex Selective Collective Operation

1. Provide simplex selective collective operation from a riser of hall push button stations.
2. The registration of one or more car calls shall dispatch the car to the designated floors. The car shall also respond to registered hall calls in the same direction of travel. Car and hall calls shall be canceled when answered.
3. Stops in response to calls that are registered in either the car or corridor pushbutton stations shall occur in the natural order of progression in which the floors are encountered, depending on the direction of car travel, and irrespective of the order in which calls are registered.
4. When the car has responded to the highest or lowest call, and calls are registered for the opposite direction, the car shall reverse direction automatically and respond to those registered calls.
5. When the car arrives at its last stop and reverses direction of travel, all previously registered car calls shall be automatically cancelled.
6. When the car has responded to the highest or lowest call, and hall calls are registered for the opposite direction, the car shall reverse direction automatically and respond to those registered calls.
7. When the car arrives at a landing where both up and down hall calls are registered, it will answer the call in the direction of travel.
  - a. After a pre-determined delay, if no car call is registered, the car shall be assigned to respond to calls registered for the opposite direction. Car doors shall close immediately, re-open and respond to the call for the opposite direction.
  - b. Hall lantern operation shall always correspond to direction of service.
8. When an empty car reverses direction at a landing with no hall calls, the doors shall not open and the hall lantern shall not operate.
9. If the car has no car calls registered and arrives at a floor where both up and down hall calls have been



registered, the car shall respond to the hall call corresponding to the direction of car travel. If, after making its stop, a car call is not registered and no other hall calls exist ahead of the car corresponding to its original direction of travel, the doors shall close and immediately reopen in response to the hall call for the opposite direction.

10. The car shall maintain its original direction at each stop until the doors are fully closed to permit a passenger to register a car call before the car reverses its direction of travel.

C. Motion Control (New)

1. Smooth stepless acceleration and deceleration of the elevator car shall be provided in either direction of travel during both single or multiple floor runs.
2. Use digital logic to calculate optimum acceleration and deceleration patterns during each run to meet the performance requirements in Section 3.5.
3. Floor leveling accuracy of  $\pm 1/4"$  as measured between the car entrance threshold and the landing sill on any given floor shall be provided.
  - a. This accuracy standard shall be maintained under varying load conditions and without need for releveling corrections caused by overshooting or stopping short of the floor.
4. Elapsed flight time during a typical elevator one floor run shall not exceed values as further specified.
  - a. Timing, as measured between the moment door closing operations begin and when the doors are 3/4 open at the next adjacent floor, shall remain consistent under varying load conditions in either direction of travel.

D. Independent Service Operation (New)

1. The car operating station shall be equipped with a key-operated switch labeled "IND SER".
2. Location of the switch to be determined by owner
3. When placed in the "on" position the following shall occur:
  - a. Group elevator - the elevator shall bypass corridor calls and travel directly to any floor chosen by registration of a car call. Hall calls shall remain registered for service by another elevator in the group.

- b. Simplex elevator - existing hall call registrations shall extinguish and hall buttons shall remain inoperative as an indication to passengers that there is no elevator service.
  4. During Independent Service Operation, the elevator doors shall remain open at any landing until the door close or car call registration pushbutton, is pressed and maintained until the doors are fully closed.
  5. If more than one (1) car call is registered, all registered car calls shall extinguish when the elevator stops in response to the first call.
  6. In case an elevator is operating on the Independent Service mode and the Fire Emergency Recall system becomes activated, the elevator shall automatically override Independent Service Operation and engage Phase I - Fire Emergency Recall Operation following a period of approximately forty-five (45) seconds.
- E. Inspection Service Operation (New)
1. Provide a key operated switch in the main car operating panel that, when turned to the 'ON' position, shall cause the elevator to be removed from service and placed in Inspection Service Operation.
  2. The car shall move at a speed not to exceed 150 feet per minute (0.75 meters per second) as per code with both the hall and car door panels in the closed and locked position.
  3. The Inspection Service switch shall be keyed differently than other typical keys used in the operation of the elevator. Keying shall be in accordance with Security Group Classifications as required by applicable code.
  4. The top of the elevator car shall be equipped with a control for limited operation of the car during repairs, maintenance and inspection conducted in the hoistway. The transfer of control to the top of car operating device shall cause that device to be the sole means of control for the elevator.
  5. Power door operating equipment shall be rendered inoperative while the car is being operated in the Inspection Service mode with the exception of power closing of the door. The control system shall maintain closing power on the door while the elevator is moving under Inspection Service Operation.
  6. The in-car Inspection Service switch shall be rendered ineffective when the top of car inspection control is activated.
  7. Machine Room Inspection Operation and Inspection Operation with open door circuits shall be provided in accordance

with A17.1 Safety Code where required or allowed by the AHJ.

F. Hoistway Access Operation (New)

1. Provisions shall be made to allow access to the hoistway through the use of hoistway access switches.
2. Operating the access switch shall permit the car to move at a speed not to exceed 150 feet per minute (0.75 meters per second) as per code with the hall and car doors in the open position to obtain access to the top of the car.
3. The car shall automatically stop motion when the car top is level with the hoistway door sill.
4. The access key switches shall be keyed differently than other typical keys used in the operation of the elevator. Keying shall be in accordance with Security Group Classifications as required by applicable code.
5. Access operation shall be disabled when top of car inspection operation is in effect.

G. Fire Emergency Operation (New)

1. Firefighters Service Operation and devices shall meet applicable code requirements of the AHJ.
2. Contractor shall be responsible for compliance in all aspects of Firefighters Service including, but not limited to the mode of operation, initiation of operation, operating /control and signaling devices as well as fixture engraving including operating instructions applicable to and where required by the specific Jurisdiction.
  - a. Phase I - Emergency Recall Operation shall be provided for each car in accordance with ASME A17.1 code as modified under the applicable local or State law.
3. Each main or auxiliary car operating station shall be provided with an indicator light and warning buzzer, each of which shall become activated whenever Phase I Operation is engaged. The warning buzzer shall cease to function once the car has completed the recall sequence and is positioned at the designated recall landing. The indicator light shall remain illuminated as long as Phase I Operation is activated.
4. A three-position, key-operated switch shall be provided on the designated recall landing to manually activate Phase I Operation. When activated, Phase I Operation shall be arranged so that in order to reset normal service, all cars must first be returned to the designated recall landing, after which the Phase I key-switch must be turned to the "OFF" position.

5. Phase II - Emergency Recall In-Car Operation shall be provided for each car in accordance ASME A17.1 code as modified under local or State law.
6. Each main or auxiliary car operating station shall be equipped with a three-position, key-operated switch to engage Phase II Operation on elevators which have completed the Phase I recall sequence and which are parked at the designated recall landing or alternate floor landing. Subsequent to activating Phase II Operation on any elevator, that elevator must be returned to the designated recall landing in order to discontinue that service mode.
7. Each main or auxiliary car operating station shall be provided with a "CALL CANCEL" push button that functions only under Phase II operating mode. When activated, pressing the "CALL CANCEL" button shall cause any previously registered car calls to cancel per ASME standards.
8. Each main or auxiliary car operating station shall incorporate the National Standard fire logo and/or operating instructions, engraved and red color filled, as required by the applicable local or State law requirements.
9. Contractor shall be responsible for compliance in all aspects of Firefighters Service including, but not limited to the mode of operation, initiation of operation, operating/control and signaling devices, including fire command panels, as well as fixture engraving, including operating instructions applicable to and where required by the specific Jurisdiction.
10. All Fire Service key switches shall be keyed to FEO-K1 national standard.

H. Emergency Power Operation

1. Existing provisions shall be duplicated and upgraded for automatic sequential operation.
2. Provisions shall be included in the new elevator control system whereby, immediately after transferring to the building emergency power system, all affected elevators shall automatically return the main fire recall landing in progressive numerical sequence at normal operating speed.
  - a. Car and corridor calls shall become inoperative and all previously registered calls shall be canceled.
  - b. As each car arrives at the designated landing, it shall park out of service with its door in the open position.
3. An illuminated signal marked "ELEVATOR EMERGENCY POWER" shall be provided in the elevator lobby at the designated level to indicate that the normal power supply has failed and the emergency power is in effect.

4. In the event an elevator fails to respond to a recall command within forty-five (45) seconds under Emergency Power Operation, that car shall be bypassed and the next car in the sequence shall be recalled.
  5. Upon completion of the recall process, one or more elevators shall be automatically selected to run on the emergency power source (duty car(s)).
  6. Interlock all elevators to allow to operate the maximum number of elevators at a time.
  7. An emergency power control panel shall be provided where indicated by the Owner containing an indicator light per elevator that becomes illuminated whenever a transfer to emergency power takes place.
    - a. Provide a key-operated override switch and a manual selector switch with a position indicator for each elevator.
    - b. Activating the key-operated override switch while on emergency power shall cancel the automatic recall sequence and allow positioning of the manual selector switch to select a car for operation.
  8. Means shall be provided adjacent to the control panel to indicate that the elevator is at the designated level with the doors in the open position.
  9. Testing of elevators under emergency power shall be accomplished with the building ATS providing a "pre-test" signal to the elevator control apparatus.
    - a. The pre-test signal shall initiate the landing of the elevators prior to the transfer from normal to emergency power.
    - b. After testing, the building ATS shall provide a "pre-transfer" signal to land the elevators prior to the transfer from emergency to normal power.
- I. Floor Lockout Feature / Keyless - Card Reader Security System / Car and Hall
1. Card Reader Control of Selected Elevators
    - a. All elevators shall be card reader controlled by the security system and or modified for future card reader capabilities, including hardware and software in the elevator controllers and car operating panels.
    - b. Control shall be on an individual floor programmable basis allowing the user to access only those floors for which their access card is programmed.

- 1) The ground floor shall always be available without the need of an access card.
- c. The security system shall provide for control of the elevator on a time programmable basis allowing access to certain floors/doors via card reader while allowing free access to other floors/doors at the same time.
  - d. When an elevator is in the card reader control mode of operation, the elevator user shall be required to hold their access card up to a card reader mounted on the elevator return panel and push the desired floor/door select button, even while in non-automatic modes of operation.
    - 1) The elevator control system shall light the selected button from the time of authorized floor/door selection until the elevator reaches the selected floor.
  - e. To place the elevator in the card reader controlled mode of operation, a maintained contact closure (provide by the security system) shall be established across a pair of elevator controller terminals (provided by the Elevator Contractor).
  - f. To provide for card reader control of elevators, the application of a dry contact open and/or closed (provided by the security system) across a pair of terminals per floor or door per elevator (provided by the Elevator Contractor) shall enable the selection of the authorized floor/door select buttons in the elevator.
    - 1) When the elevator is in the card reader controlled mode, the contacts provided by the security system shall be open and shall close for five seconds upon reading a valid card to allow the floor to be selected and the call for that floor registered.
    - 2) When the elevator is in the non-reader controlled mode, the contacts shall be closed, allowing the floor to be selected without a card reader.
  - g. When the hall call button is in the card reader controlled mode of operation, the elevator user shall be required to hold an access card up to a card reader mounted adjacent to the hall call station to enable activation of the hall call button.

- 1) The acknowledging light shall illuminate the time of authorized activating until the elevator arrives.
  - h. The security system shall provide for card reader control of the elevator hall call button on a time programmable basis.
  - i. To provide for card reader control of the elevator hall call button, provide a pair of terminals such that the application of a dry contact closure across those terminals by the security system shall enable the activation of the hall call button.
  - j. When the hall call station is in the card reader controlled mode, the security system shall place a closure across the contacts for five seconds upon reading a valid card to allow for activation of the button.
  - k. When the hall call station is in the non-reader controlled mode, the security system shall maintain a closure across the contacts allowing the hall call button to be selected without an access card.
2. Design and interface security control with primary control signaling for fire or other emergency control override features per local law.
- J. Floor Lockout Feature / Keyless - Card Reader Control / Wiring Provisions
1. Wiring: Provide six (6) pair of 20 gauge two (2) flexible conductor low voltage cables with an overall braided shield in the traveling cable of all elevators for card reader interface.
    - a. The cables shall extend from the security interface terminal cabinet in the elevator machine room to behind the elevator return panel above the space allotted for the card reader.
    - b. Terminate the cable to dual screw barrier terminal strips on each end.
  2. Card Reader Space: Allocate card reader space in each main car station as directed by the Owner. A removable flush mount face plate shall be integrated in the main car operating panel, with final design as approved by the owner. Any required mounting provisions will be included in the panel for existing and future applications.
  3. Interface: For floor programmable card access control in all elevators, provide a pair of terminals for all floors such that application of a momentary dry (no voltage

present) contact closure across those terminals by the security system shall enable the selection of the corresponding floor from the floor selector button in the elevator cab.

- a. Locate the terminals inside an interface terminal cabinet in the elevator machine room.
  - b. Provide all relays required to interface the elevator control system to the momentary dry contact closures provided for under another section of these specifications.
  - c. If applicable, the card reader shall be operable and compatible with the issued card keys used building wide.
  - d. Coordinate system requirements with the manufacturer of the issued card key system.
4. Card Reader "Secure/Bypass" Switch: Provide separate card reader control bypass key switches for each elevator.
- a. The bypass key switches shall be located in the Director's Control Panel.
  - b. The bypass key switches shall be a maintained contact type key switch with the key removable in the secure or bypass position.
    - 1) When the key switch is in the secure position, the card reader control mode shall be initiated.
    - 2) When in the bypass position, the card reader control mode shall be bypassed and the elevator shall return to normal operation, permitting free access to any floor.
5. The card reader operation shall bypass floor cut-out switches.
6. Firefighter controls shall override all security operations.
7. Monitoring of Elevator Duress Alarm Buttons
- a. The security system shall provide auxiliary monitoring of the duress alarm buttons in each elevator.
  - b. Activation of an elevator duress alarm button shall cause an alarm indication on the security system operator's terminal.
  - c. To provide for monitoring of the elevator duress alarm button, provide a pair of terminals per elevator such that when the duress button is activated, a normally closed dry contact across those terminals shall open and remain open for as long as the duress button is activated.



8. CCTV Camera Surveillance of Elevators

- a. A camera shall be installed in each elevator cab with a location to be determined by the VA, to provide for camera surveillance of all passenger elevators.
- b. Include labor and coordination to install all equipment in the new cabs. Wiring for future cameras will be installed in an easily accessible junction box on the car top.
- c. The wiring for the future cameras shall extend from the security interface terminal cabinet in the elevator machine room to the top of the elevator, in an electrical box which is easily accessible.

9. Firemen's Override

- a. Firemen's override and automatic recall functions shall bypass all security elevator control functions.

10. System Interface

- a. Provide a terminal cabinet in each elevator machine room for elevator / security system interface. The terminal cabinet shall contain all terminals required to interface the elevators located in the machine room to the security system.

11. Submittals

- a. Submit product specifications, fabrication shop drawings, and wiring diagrams of the following:
  - 1) Elevator / Security interface terminal cabinet.
  - 2) Card reader installation.
  - 3) CCTV camera installation.
  - 4) Key switch installation.
  - 5) Traveling Cables.

12. Interface Terminal Cabinet

- a. The interface terminal cabinet shall be a lockable continuous hinge cover NEMA Type 1 enclosure.
- b. The cover of the enclosure shall be labeled to identify its function.
- c. Dual screw barrier type terminal strips shall be provided within the interface terminal cabinet.
  - 1) Terminals shall be provided for each interface point.

- 2) All terminals shall be labeled to identify their function.

### 13. Traveling Cable

- a. The card reader interface traveling cable shall be one (1), twelve (12) conductor 20 gauge stranded, low voltage cable with an overall braided shield and drain wire.
- b. The CCTV camera interface traveling cable shall be two (2), RG-59U stranded center conductor coax cables and one (1), two (2) conductor 20 gauge stranded, low voltage cable with an overall braided shield and drain wire.
- c. One (1) RG-6 Ethernet
- d. All security interface traveling cables shall be located in the elevator control traveling cable and shall be isolated from other traveling cables used to carry high voltage alternating current circuits.

### 14. Interface Terminal Cabinet Installation

- a. Install the interface terminal cabinet within the elevator machine room in a readily accessible location no more than 6'-0" AFF.
- b. Provide any control logic and relays that will be required to interface the elevator control system to the dry contact closures (rated for 1 AMP at 24 VDC) provided by the security system.
- c. Provide interconnect wiring from the elevator control system to the interface terminal cabinet.
- d. The security contractor shall wire from the security system to the interface terminal cabinet.

### 15. Card Reader and CCTV Camera Installation

- a. The card reader and CCTV camera shall be provided by the security contractor and installed by the Elevator Contractor.
  - 1) The security contractor shall provide supervision, wiring details and installation diagrams to the Elevator Contractor.
- b. The exact card reader and CCTV camera locations shall be specified by the Owner.

### 16. Traveling Cable Installation

- a. Traveling cables for card reader interface shall extend from the elevator / security interface terminal cabinet

in the elevator machine room to behind the elevator return panel.

- b. Terminate the cables including the drain wire to dual screw barrier terminal strips in the interface cabinet and provide 6 feet of excess cable behind the elevator return panel.
- c. The Elevator Contractor shall be responsible for connecting the cable behind the return panel to the card reader under the direct supervision of the security contractor.
- d. Traveling cables for the CCTV camera shall extend from the elevator / security interface terminal cabinet in the elevator machine room to the top of the elevator cab and connect to the previously mentioned top of car junction box

#### 17. Conduit, Power and Wiring

- a. Provide all conduit, power and wiring required for the installation of the terminal cabinet, traveling cables and interfacing to the elevator control system.
- b. Provide one (1) 120V duplex unswitched outlet dedicated to security on top of each elevator equipped with CCTV camera.
- c. The security contractor shall provide all wiring from the interface terminal cabinet to the security system.

#### 18. Automatic Bypass of Card Reader Control of Elevators

- a. The card reader control of elevators shall be automatically bypassed by the security system upon a fire alarm condition.
- b. To provide for automatic bypass, the fire alarm contractor shall provide a normally closed dry output contact from the fire alarm system.
  - 1) Upon a fire alarm condition, the contact shall open the elevator system shall bypass the card reader control of elevators.
  - 2) The contact shall remain open until the fire alarm system is manually reset.

#### 19. System Interface

- a. To provide for interfacing the dry contact output from the fire alarm system to the elevator system. The fire alarm contractor shall provide an interface to the elevator system for card reader controlled Elevators.

- K. See "Fixtures" for specific hall station and car operating panel requirements.
- L. Car-to-Lobby Operation
1. Provide a key-operated Car-to-Lobby feature.
    - a. Provide a 3-position key-operated switch for each elevator in the lobby control panel or at a location as directed by the Owner to activate the Car-to-Lobby operating feature.
  2. When engaged, this feature shall:
    - a. Cause the affected elevator to return non-stop to the lobby after it has discharged all registered car calls.
    - b. Open the door upon arriving at the lobby for approximately ten (10) seconds, after which the elevator shall park out of service with the door closed.
    - c. Maintain door open button function during the interval in which the car is out of service.
  3. Returning the key-operated switch in the lobby panel to the "on" position shall restore the car to normal operation.
  4. The Car-to-Lobby operating feature shall be overridden by Phase I - Fire Emergency Operation and inoperative during Phase II - Fire Emergency Operation.
- M. Low Oil Protection and Protective Device (Hydraulic Elevator)
1. Provide low oil protection operation and appropriate device(s) that will discontinue operation of the hydraulic elevator pump when:
    - a. The elevator stalls due to a low oil condition
    - b. Fails to reach the landing in the up direction
  2. Pressure Switch:
    - a. Where the top of the cylinder head is above the top of the tank, provide a pressure switch between the cylinder and the valve which shall be activated by the loss of pressure at the top of the cylinder, and control the operation of the elevator as required by Code.
  3. Provide an additional protective device that shall automatically return the elevator to the bottom landing, open the door and shut down the system.

4. The protective device shall be an integral part of the control system.

N. Hydraulic Auto Lowering (Hydraulic Elevator)

1. Provide automatic battery powered lowering feature for the hydraulic elevator.
  - a. In the case of normal power outage, the elevator shall be automatically lowered to the Main Lobby level.
  - b. The door shall open automatically to discharge passengers.
  - c. The elevator shall remain parked with its door closed and door open button operative until normal power is restored.
2. The control panel shall be located in the machine room or be an integral part of the control system.
  - a. It shall include necessary batteries, solid-state controls, charger, monitor lights and a test button.
  - b. It shall be fed by a 120 volt, 20 Ampere branch circuit from the emergency power source, provided by other trades.
3. Provide necessary circuitry within the controller to determine the difference between an "intentional" loss of power and an "actual" loss of power in order to prevent operation of the auto lowering unit when the main line disconnect has been opened for elevator servicing.
4. Provide necessary terminals for connection to an auxiliary switch in main line disconnect provided by other trades.

O. Door Operation

1. Car and hoistway doors shall be arranged to operate in unison without excessive noise or slamming in either direction of travel.
  - a. Door opening speeds of two (2) feet per second shall be provided in conjunction with closing speeds of 1.0 feet per second in accordance with governing code.
  - b. Door operation shall commence as the car stops level at the floor and the machine brake is applied. Pre-door opening shall not be permitted.
2. Door open and door close time shall be measured between the moment car door operation in either direction begins and the instant at which that cycle is completed.

3. When responding to either a car or corridor call, the amount of time that the elevator door remains stationary in the open position shall be adjustable up to sixty (60) seconds.
  - a. Door open dwell time for a corridor call shall be separate of that for a car call, and in both cases, dwell time shall be canceled whenever the car door protection device is momentarily interrupted by passenger transfers, followed by a reduced door open dwell time of approximately one (1) second (adjustable) after the door protection device is cleared of obstructions.
4. The operation of the door protective device by the interruption of one or more infrared light beams during the close cycle shall cause the immediate reversing of the doors to the full open position.
5. The door closing cycle shall be arranged so that, in the event the door protective devices become continually obstructed after the normal door open dwell time has expired, and following a time interval of approximately thirty (30) seconds (adjustable), a warning tone shall sound and the door closing cycle shall commence at reduced speed and torque per applicable Code requirements.
6. Each car operating station shall be provided with a "door open" and "door close" push button.
  - a. Pressure on the "door open" button shall cause doors in the full open position to remain so and doors engaged in the close cycle to reverse direction and assume the full open position so long as pressure remains applied to the button.
  - b. The "door open" buttons shall also control the open cycle during Phase II - Emergency In-car Operation.
  - c. The "door close" push button shall function on Independent Service, Attendant Service and Phase II - Emergency In-car Operation as well as during normal automatic operations.
7. Each car operating station shall be provided with a "door hold" push button.
  - a. Pressure on the "door hold" button shall cause doors in the full open position to remain in the open position and doors operating in the close cycle to reverse direction and travel to the full open position for an extended (adjustable) period of time to allow for loading and unloading.

- b. The "door hold" feature shall be overridden when the elevator is on Fire Emergency Phase I and Phase II or when code blue (Hospital service) operation is activated.
  - c. The "door hold" feature shall be cancelled when the "door close" button is pressed.
8. Repeated attempts by the power door operator to open or close the door at any landing shall be monitored by the control system.
- a. In the event the door fails to cycle properly after a preset (adjustable) number of attempts, the car shall either travel to the next stop or remove itself from service, depending upon whether the malfunction is in the open or close cycle.
9. Each hoistway door shall be provided with an automatic self-closing mechanism arranged so that the door shall close and lock if the car should leave the landing while the hoistway door is unlocked.
10. Car doors shall be arranged to prevent their being manually opened from inside the car unless the elevator is positioned within a floor landing zone.

## 2.4 MACHINE ROOM / SECONDARY EQUIPMENT

### A. Control Equipment (New)

- 1. Provide a new non-proprietary microprocessor-based elevator control system.
- 2. Digital logic shall calculate optimum acceleration, deceleration and velocity patterns for the car to follow during each run.
- 3. Closed-loop distance and velocity feedback shall monitor the actual performance of the elevator car with the desired speed profile.
- 4. System operating software shall be stored in non-volatile memory.
  - a. Elevator control relays, contactors, switches, capacitors, resistors, fuses, circuit breakers, overload relays, power supplies, circuit boards, static motor drive units, wiring terminal blocks and related components shall be totally enclosed inside a free-standing metal cabinet with hinged access doors.
  - b. Mechanical ventilation or air conditioning of the cabinet shall be provided and shall be adequate to

dispose of the full load heat losses without exceeding 40° C (104° F) ambient temperature.

- 1) Where integral air conditioners are not employed, control equipment cabinets shall be provided with forced air ventilation to prevent overheating of the electrical components housed therein.
  - 2) Where integral air conditioners are employed, control equipment cabinets shall be "NEMA 12" rated with no ventilation fans or slots.
- c. All electrical wiring inside the control equipment cabinet shall be performed in a neat manner with field wiring terminated at stud blocks provided inside the control cabinet.
- d. Each wiring terminal shall be clearly identified according to the nomenclature used on the "as built" wiring diagrams. No more than two (2) field wires may be connected to any single terminal stud.
- e. Spare wires shall be tagged according to their point of termination, bundled, and placed at the bottom of the control equipment cabinet.
- f. Each electrical component within the cabinet shall be permanently identified with symbols, identical to those used on the "as-built" wiring diagrams.
- g. A data plate that indicates the edition of the Code in effect at the time of installation and/or alteration shall be provided in accordance with applicable code and requirements of ASME A17.1 Code. The data plate shall be in plain view and securely attached on the mainline disconnect or on the controller.
- h. Control equipment shall comply with requirements of all applicable Sections of the ASME A17.1 Code as approved and adopted by the AHJ.
- i. A 17" flat-panel LCD monitor shall be provided inside the elevator machine room for diagnostic purposes. The monitor shall be permanently mounted in a cabinet, on a shelf immediately adjacent or attached to or in a control cabinet of at least one car of a group. By means of graphic depiction, information available on the screen shall include:
- 1) An overview of car and corridor calls currently existing within the system.
  - 2) Elevator operating status.
  - 3) Elevator position, direction of travel and velocity.
  - 4) The open/close status of elevator door.



- 5) The current operational status of each CPU input and output.
  - 6) A sequential history of faults detected within the control system over the previous thirty (30) days.]
  - 7) Password protection of critical programming features is required to prevent accidental changes to life-safety and other non-typical control settings.
  - 8) Where a separate dispatch or group control panel is provided, a separate "LCD" display shall be provided to view group functions.
5. In the event diagnostics and monitoring is accomplished via Field Service Tools, provide the required Field Service Tools with related control system appurtenances for diagnostic evaluations, system monitoring and field adjustments.
- a. Provide instructions for proper use of such diagnostic tools and/or equipment with all coding and other operational requirements.
  - b. Maintain and calibrate the diagnostic tools, and update the associated instructions and other related documents under the service agreement.
    - 1) Should the agreement be cancelled for any reason by either party, maintenance and updating of diagnostic tools shall be provided to the Owner at the Contractor's cost without the need to purchase or lease additional diagnostic devices, special tools or instructions from the original equipment provider.
    - 2) The Owner may request field and technical instructions be provided by the original installation contractor or manufacturer for proper servicing by other qualified elevator company personnel.
    - 3) The established cost plus profit, as previously specified, shall be applicable for the life of the system.
      - a) If the equipment for fault diagnosis is not completely self-contained within the controllers but requires a separate detachable device, that device shall be furnished to the Owner as part of this installation.
      - b) Such device shall be in possession of and become property of the Owner.

6. Microprocessor Documentation

- a. Provide and/or obtain complete information on systems' design, component parts, installation and/or modification procedures, adjusting procedures and associated computer conceptual logic circuitry and field connection.
- b. Provide microprocessor upgrading and/or modifications to programs that have been assigned to enhance the operation of the equipment for a period of 10 years after project approval.

B. Equipment Isolation

1. Provide sound reducing vibration isolation elements at all support points of elevator controller, solid-state motor drives, isolation transformers, reactance units, Pump motors and machines.
2. The elements for controllers, solid-state motor drives and isolation transformers shall be similar to double deflection neoprene-in-shear mounts, as manufactured by Mason Industries, Type ND, with 0.35" static deflection under design load ratings.
3. Elements between the machine unitized base and machine support shall be similar to triple layer ribbed neoprene pads, separated by appropriate steel shims as manufactured by Mason Industries, Type W pads, at 50 durometer, loaded for 40 psi or approved equal.
4. All bolts through isolation elements, where necessary, are to incorporate resilient washers and bushings.
  - a. Existing isolation pads shall be replaced with new.

C. Hydraulic Power Unit / Motor (New)

1. Provide a self-contained power unit which includes:
  - a. Structural steel outer base
  - b. Tank support
  - c. Oil tight drip pan
  - d. Floating inner base to prevent metallic contact for mounting the motor pump assembly.
  - e. Sound isolation panels to enclose the unit and reduce airborne noise.
2. Provide a reinforced overhead oil reservoir with a tight fitting tank over the oil control unit which includes:
  - a. An oil fill strainer with air filter
  - b. An oil level gauge assembly

- c. A self-cleaning strainer in the suction line.
  - 3. The pump shall be for oil hydraulic elevator service with positive displacement screw type design for steady discharge with minimum vibration.
  - 4. The drive shall be by multiple V-Belts and sheaves or directly driven by a submersible pump depending on the HP requirements of the system.
    - a. The use of submersible pumps having more than a 40 HP motor is unacceptable.
  - 5. Pump drive motor control shall utilize solid state motor starter circuitry to provide reduced current starting and maximum protection of the motor.
  - 6. The oil control unit shall be of the manufacturer's own design but shall include relief, safety check, start and slow down valves.
    - a. Use lowering and leveling valves for drop away speed, lowering speed, leveling speed and stopping speed to insure smooth down starts and stops.
    - b. Provide a valve for manual lowering of the elevator car in event of power failure and for use in servicing and adjusting the elevator mechanism.
    - c. Design the tank shut-off valve for isolating oil in the power unit tank to ensure each of servicing and adjusting the elevator mechanism without removing oil from the tank.
    - d. All valves shall be accessible for adjustment without removing the assembly from the oil line.
  - 7. Manufacture the unit to operate under [400 psi (for dry units)/600 psi (for submersible units)] working pressure.
  - 8. Provide a thermostatically controlled heater in the oil tank to maintain proper operating oil temperature.
  - 9. When the oil reservoir thermostat registers 50 degrees F, the car shall "exercise" until the oil temperature reaches 75 degrees F.
- D. Hydraulic Piping (New)
- 1. Provide all necessary pipes and fittings to connect the power unit to the jack.
    - a. Use minimum Schedule 80 steel pipe.
    - b. Provide a shut-off valve in the machine room for maintenance service.

2. The oil pipe and conduit shall be overhead above suspended ceiling.
  - a. Exact location must be coordinated with other trades.
  - b. For pipe hangers use spring hangers Type 30 of Mason Industries, Inc. or approved equal.
  - c. Provide neoprene isolation pads between the pipe and the hangers.
3. Adequately support the full run of pipe with isolation type support.
4. Where flexible hose and fitting assemblies, and flexible couplings are used for hydraulic connections, flexible hose and fitting assemblies shall:
  - a. Not be installed within the hoistway, nor project into or through any wall.
  - b. Installation shall be accomplished without introducing twist in the hose, and shall conform to the minimum bending radius of SAE 100 R2 type, high pressure, steel wire reinforced, rubber covered hydraulic hose specified in SAE J517.
  - c. Have a bursting strength sufficient to withstand not less than 10 times the working pressure.
  - d. Be permanently marked indicating:
    - 1) Manufacturer of the hose and fittings
    - 2) Type of hose and fitting
    - 3) Minimum factory test pressure
    - 4) Minimum bending radius of the hose
    - 5) Date of installation
    - 6) Inspection procedure
    - 7) Name of elevator contractor

E. Hydraulic Mainline Oil Strainer (New)

1. Provide a mainline hydraulic oil strainer of the self-cleaning, compact type, equipped with a 40 mesh element and installed in the oil line.
2. Design the strainer for maximum system working pressure.

2.5 HOISTWAY EQUIPMENT

A. Guide Rails / Inserts / Brackets (Reuse)

1. Car and counterweight guide rails, fish plates, rail brackets, backing support and related attachments shall be inspected to determine if unfavorable conditions exist that diminish the structural integrity of any component.

- a. In the event substandard conditions are disclosed by means of this inspection, the Contractor shall immediately undertake whatever repairs and/or replacements may deem appropriate to remedy the situation.
2. Each stack of guide rails shall be individually examined to determine if excessive compression has occurred from building settlement.
  - a. In the event such conditions are found to exist, each affected stack shall be cut off enough to relieve pressure.
  - b. Jacking bolts shall be provided underneath each stack of both car and counterweight guide rails.
3. Each stack of guide rails shall be realigned so that total deviation from plumb in any direction does not exceed 1/8" over the entire length of the hoistway and that DBG measurements never vary more than .030".
4. As required, car guide rails joints shall be individually filled, filed and sanded in order to eliminate minor variations in adjoining machined surfaces.

B. Roller Guides (New)

1. Provide roller guide shoes with adjustable mounting base, rigidly bolted to the top and bottom of each side of the car and counterweight frame.
  - a. Roller guides shall consist of a set of sound reducing neoprene wheels in precision bearings held in contact with the three finished rail surfaces by adjustable stabilizing springs.
  - b. The bearings shall be sealed or provided with grease fittings for lubrication.
  - c. Equip roller guides with adjustable stops to control postwise float.
  - d. Fit the top car roller guides with galvanized, painted or powder coated steel guards.
2. Approved applications and manufacturers.
3. Roller guides shall not be installed on counterweight frames where traveling buffers with separate guide shoes are employed and lubrication of the rails is necessary for quiet guide operation.
4. Roller guides shall not be installed on counterweight frames where counterweight safeties are employed and prevailing conditions prohibit installation due to

limitations in clearances or in cases where rollers will interfere with the operation of the safety plank.

C. Electrical Conduit / Wiring / Traveling Cable (New)

1. Electrical wiring shall be provided.
  - a. All wiring shall be stranded copper conductors, manufactured in compliance with ANSI/ASTM B174-71 and UL 62 requirements, and polyvinyl chloride insulation complying with ETT requirements of UL 62 and Article 400 of the National Electric Code.
  - b. Electrical wiring provided for hoistway interlock shall be of a flame retardant type, capable of withstanding temperatures of at least 392 degrees Fahrenheit. Conductors shall be Type SF or equivalent.
  - c. Each run of electrical conduit or duct shall contain no less than 10% spare wires and, in any case, no fewer than two (2) spare wires.
  - d. Crimp-on type wire terminals shall be used where possible. Junction boxes on the car shall be equipped with terminal blocks. Terminal blocks having pressure wire connectors of the clamp type that meet UL 486A requirements for stranded wire may be used in lieu of terminal eyelet connections.
  
2. Traveling cable shall be provided. (New)
  - a. Each traveling cable shall be provided with a flame and water resistant polyvinyl chloride jacket.
  - b. Electrical wiring shall consist of stranded copper conductors, manufactured in compliance with ANSI/ASTM B174-71 and UL 62 requirements, and polyvinyl chloride insulation complying with ETT requirements of UL 62 and Article 400 of the National Electric Code.
  - c. Each traveling cable shall contain no less than 10% spare wires.
  - d. Traveling cable exceeding 100' in length shall be provided with a steel wire rope support strand from which the cable shall be suspended.
  - e. Traveling cable must be contained within an approved electrical conduit to within 6' of the final suspension point in the hoistway.
  - f. Each traveling cable shall be arranged to provide no fewer than six (6) individually shielded pairs of 20 gauge wire and arranged to contain no less than two (2) RG6 coaxial cable, one (1) RG-6 Ethernet cable for Wi-Fi and 2 pair (14 gauge) wires for CCTV power for CCTV remote monitoring.

- g. Traveling cable conductors that terminate at a hoistway center box shall be connected to stud blocks provided for that purpose.
    - 1) Each wiring terminal shall be clearly identified by its nomenclature as shown on the "as built" wiring diagrams and solderless, crimp-on type wire terminals shall be used where possible.
  - h. The attachment of a traveling cable to the underside of the elevator car shall be performed so that a minimum loop diameter of 30x the cable diameter is provided.
  - i. Pre-hang the cables for at least 24 hours with ends suitably weighted to eliminate twisting during operation.
3. Rigidly supported EMT conduit, flexible metal conduit and galvanized steel trough shall be utilized throughout the hoistway.
- a. Both EMT and flexible conduit shall be connected on either end by use of compression fittings and secured in place with metal clamps sized in accordance with the diameter of conduit utilized.
    - 1) Wire or plastic wire ty-raps shall not constitute an acceptable means of fastening.
  - b. The use of flexible metal conduit shall be limited to runs not greater than 3' in length.
  - c. All abandoned or unused electrical conduit shall be removed from the hoistway.
  - d. If traveling cables come into contact with the hoistway or elevator due to sway or change in position, provide shields or pads to the elevator and hoistway to prevent damage to the traveling cables.
  - e. Hardware cloth wide may be installed from the hoistway suspension point downward to the elevator pit to prevent traveling cables from rubbing or chafing. Hardware cloth shall be securely fastened and tensioned to prevent buckling. Hardware cloth is not required when traveling cable is hung against a flat wall.
  - f. All wiring and electrical connections for CCTV (including future provisions) shall terminate in an electrical junction box located on a corner of the car top, final location to be approved by the Owner.
  - g. All wiring and electrical connections for security operation in the car shall be terminated on stud blocks in the car operating panel.

h. Existing conduit and wiring duct may be reused if suitable for the application.

1) Reuse of existing conduit/duct shall be at the discretion of the Government.

D. Normal and Final Terminal Stopping Devices (All Elevators - New)

1. Provide normal terminal stopping devices to stop the car automatically from any speed obtained under normal operation within the top and bottom overtravel, independent of the operating devices, final terminal stopping device and the buffers.
2. Provide final terminal stopping devices to stop the car and counterweight automatically from the speed specified within the top clearance and bottom overtravel.
3. The terminal stopping devices shall have rollers with rubber or other approved composition tread to provide silent operation when actuated by the cam fixed to the top of the car.
  - a. Terminal stopping devices that are not mechanically operated (i.e.: magnetic proximity) shall be provided by the manufacturer of the control equipment, intended for use as a terminal limit, and designed for reliable operation in the hoistway environment.
4. Final terminal limits shall be pinned so as to prevent movement after final adjustment where required by the AHJ.



## 2.6 PIT EQUIPMENT

### A. Pit Stop Switch (New)

1. Where pit depth does not exceed 67", each elevator pit shall be provided with a push/pull or toggle switch that is conspicuously designated "EMERGENCY STOP" and located so as to be readily accessible from the hoistway entrance on the lowest landing served at a height of approximately 18" above the floor.
  - a. This switch shall be arranged to prevent the application of power to the hoist motor and machine brake when placed in the "OFF" position.
2. Where climb-in pit depth exceeds 67", each pit shall be provided with two (2) push/pull or toggle switches conspicuously designated "EMERGENCY STOP".
  - a. Both of these stop switches, shall be located immediately adjacent to the pit access ladder.
    - 1) Place one stop switch approximately 47" above the pit floor.
    - 2) Place the second stop switch 18" above the hoistway entrance sill on the lowest landing served.
    - 3) These switches shall be arranged so as to prevent the application of power to the hoist motor or machine brake when either one is placed in the "OFF" position.

### B. Jack Unit (Reuse)

1. The existing jack shall be reused.
2. The jack shall undergo the following work:
  - a. Check plunger for smooth surface and eliminate burrs where necessary.
  - b. Verify plunger sections are securely attached with minimum seam.
  - c. Check stop-ring for proper fit.
  - d. Renew internal babbitt-lined, guide bearing, packing or seals where necessary.
  - e. Clean drip ring around cylinder top to provide adequate drainage.
  - f. Check mounting hardware and welds where applicable.
  - g. Check secure attachment of head.
  - h. Remove rust and apply rust inhibiting paint.

3. Perform static load test of the jack unit to determine if there are any failures of the cylinder wall.
4. Where double-walled cylinders are not provided, and where prevailing conditions allow, install a plunger gripper to prevent freefall of the elevator in the event of a catastrophic failure of the hydraulic jack.

C. Hydraulic Check Valve (New)

1. A check valve shall be provided and installed so that it will hold the elevator with rated load at any point when the pump stops and the down valves are closed or the maintained pressure drops below the minimum operating pressure.

D. Rupture Valve (New)

1. An overspeed valve shall be provided and installed so that it will cause the flow of oil from the hydraulic jack through the pressure piping to cease when such flow exceeds a preset value relative to car speed in accordance with applicable codes.

E. Scavenger Pump (New)

1. Provide a positive displacement, rotary type pump for the hydraulic elevator.
  - a. The pump shall have a 1/3 HP motor capable of pumping 100 ft. vertically.
  - b. The pump shall be self-priming and self-lubricating.
  - c. The pump shall be equipped with a 100 mesh screen strainer.
  - d. The pump housing shall be constructed of brass with stainless steel internal parts, and shall have a 3.5 gallon reservoir.
2. Mount oil return pump off the pit floor and connect it to the jack unit and the oil tank with copper tubing.

2.7 HOISTWAY ENTRANCES

A. Hoistway Entrances (Reuse)

1. Hoistway entrance sills, sill supports, entrance frames, headers and header supports shall be reused and refurbished.

- a. Hoistway entrances that have become distorted or bent shall be straightened, plumbed, reset to the proper width dimension and reinforced as necessary.
- b. Provide 14 gauge steel fascia plates that extend at least the full width of the door and be secured at hanger support and sill with oval head machine screws.
  - 1) Reinforce fascia to allow not more than ½" of deflection.
  - 2) Provide fascia plates where the clearance between the edge of the loading side of the platform and the inside face of the hoistway enclosure exceeds the code allowed clearance.
- c. Provide 14 gauge steel toe guards that extend 12" below any sill not protected by fascia.
  - 1) The toe guards shall extend the full width of the door and shall return to the hoistway wall at a 15 degree angle and be firmly fastened.
- d. Remove the inactive switch located in each entrance jamb and Install block out plates over the opening finished to match the entrance finish.
- e. Remove oil, dirt and impurities on new and existing apparatus and give a factory coat of rust inhibitive paint to all exposed surfaces of struts, hanger supports, covers, fascias, toe guards, dust covers and other ferrous metal.

B. Slide Type Hoistway Door / New in Existing Frame

1. Provide a new elevator hoistway entrance door reusing existing entrance frame.
2. Each new door shall be as follows:
  - a. Hollow metal construction
  - b. 1-1/2 hour fire-rated test approved with required label
  - c. Manufactured of cold rolled furniture steel
  - d. Flush design both sides
  - e. Rigidly reinforced
  - f. Sound deadened
3. Where conditions warrant, and where otherwise required by code, equip all hoistway landing doors with one-piece full height non-vision wings of material and finish to match hall side of door panels.
4. Provide each door panel with two removable laminated plastic composition guides, arranged to run in existing sill grooves with a minimum clearance.

- a. The guide mounting shall permit their replacement without removing the door from the hangers.
  - b. A steel fire stop shall be enclosed in each guide.
5. Provide the meeting edge of center opening doors with necessary new continuous rubber astragal bumper strips.
- a. Astragal shall be relatively inconspicuous when the doors are closed.
  - b. Provide rubber bumpers at the top and bottom of each section of door to stop them at their limit of travel in the opening direction.
6. Provide a special key so that an authorized person can open any landing door when the car is elsewhere.
- a. The key hole shall be not less than 3/8" in diameter and shall be fitted with a stainless steel ferrule to match related equipment.
7. Finish all door panels to match elevator entrances, color as selected by Owner.
8. Where conditions require, provide necessary new masonry around existing entrance frames to maintain fire rating. Painting or other wall surface decorating will be by other trades.

C. Tracks / Hangers / Closers / Related Equipment (New)

1. Formed or extruded steel landing door hanger tracks shall be provided.
2. Each landing door panel shall be suspended from a pair of door hanger assemblies that are compatible with the hanger tracks.
  - a. Hanger assemblies shall be directly mounted to the door panel using 3/8" diameter or better hardware.
  - b. Solid steel blocks shall be used where job-site conditions dictate the use of spacers between hanger assemblies and the landing door panel.
  - c. Hanger assemblies shall be adjusted or shimmed so that door panels are suspended in a plumb manner with no more than 3/8" vertical clearance to the cab entrance threshold.
  - d. Upthrust rollers shall be adjusted for minimal operating clearance against the bottom edge of the hanger track.
  - e. Means shall be provided to prevent hangers from jumping the track.

- f. Blocks shall be provided to prevent rollers from overrunning the end of the track.
  - 3. Each set of center opening landing doors shall be provided with a cable driven relating mechanism which is compatible for use with the door hanger assemblies.
    - a. The relating mechanism shall be properly tensioned and adjusted so as to equalize the relationship between the door panels and the hoistway entrance.
  - 4. Each set of single, multi-speed, center opening or side slide landing doors shall be provided with a sill-mounted spring closing mechanism with necessary door panel relating hardware.
  - 5. Where applicable, each hoistway door interlock assembly shall be provided with an emergency release mechanism utilizing manufacturers' standard type access key at all landings served.
    - a. Drill each hoistway door to accommodate manufacturers standard lock release key and install escutcheon.
      - 1) Escutcheon shall be brushed stainless steel to match door panels where required.
      - 2) Aluminum shall be provided at all other typical floors.
  - 6. Where multi-speed side slide door panels exist, provide a secondary interlocking device that will prevent separation of the panels should the sill closer or relating cable(s) fail.
- D. Interlocks / Unlocking Devices (New)
- 1. Each set of landing doors shall be provided with a complete electromechanical interlock assembly.
    - a. Each interlock assembly shall consist of:
      - 1) A switch housing with contacts
      - 2) Lock keeper
      - 3) Clutch engagement/release subassembly
      - 4) Associated linkages
    - b. Arrange the lock so that individual leading door panels (side slide or center opening) are locked when in the closed position.

2. Non-typical mounting arrangements for interlocks and/or related mechanisms must receive prior approval from the Government.
3. Each hoistway door interlock assembly shall be provided with an emergency release mechanism utilizing a drop-leaf type access key at all landings served.
  - a. Each hoistway door shall accommodate manufacturer's standard lock release key with escutcheon.
    - 1) The key hole shall be fitted with a metal ferrule that matches the door finish.
    - 2) Drilling key holes in the field will not be accepted.

E. Hoistway Door Bottom Guides / Safety Retainers (New)

1. The bottom of each side sliding type hoistway door panel shall be equipped with a minimum of two (2) guiding members.
  - a. Metal mounting angles shall be secured to the integral panel frame structure; and when conditions warrant, additional external metal support plates or angles shall be installed to ensure the integrity of the panel frame is not compromised.
  - b. Guides shall be manufactured of low friction non-metal material with sufficient strength to withstand forces placed on door panels per ASME A17.1 Standards.
  - c. Each guide assembly shall incorporate a steel wear indicator and be so designed to permit sliding member replacements without removal of door panel(s) from top hanger devices.
  - d. Panels shall be hung with a maximum vertical clearance of 3/8 inch between top of sill and bottom of panel and the guide shall engage the sill groove by not less than 1/4 inch.
2. The bottom of each side sliding type hoistway door panel shall be equipped with a guiding member safety retainer to prevent displacement in the event of primary guide means failure.
  - a. A metal reinforcement (12 gauge stainless or galvanized steel) shall be installed between the two (2) primary guiding members (a.k.a. "Z" bracket).
  - b. The reinforcement shall be designed with a minimum length of 8 inches or the maximum possible length that will fit between the primary members and a minimum

overall height of 2.5 inches secured on the internal face of the door panel. (Hoistway side)

- c. The retainer shall be set with the supplemental safety angle 3/8 inch into the corresponding sill groove; and be capable of preventing displacement of the panel no more than 3/4 inch with an applied force of 1125 lbf at right angles over an area 12 inches x 12 inches at the approximate center of the door panel.

## 2.8 CAR EQUIPMENT / FRAME

### A. Car Frame (Reuse)

1. The existing car frame assembly shall be refurbished to as new condition and reused.
2. Individual car frame members, platform isolation framework, door operator support structure, related bracing and hardware shall be inspected for any indication of damage or distortion.
  - a. Where damage is detected, the Contractor shall immediately inform the Government and then undertake corrective action deemed appropriate by the Government to remedy the condition.
3. Provide new elastomer isolation pads for all existing platforms where pads are presently installed.
4. The car frame, door operator support and related bracing shall be modified or reconfigured as necessary in order to accommodate new cab enclosure and/or master door operating equipment specified herein.
5. The elevator car shall undergo static balancing upon substantial completion of all work described in the project specifications and subsequent to any car interior refinishing or cab replacement work performed in conjunction with the project.
6. The 2:1 rope sheave shall be refurbished:
  - a. The sheave shall be washed clean of accumulated grease and oil.
  - b. Bearings which are found worn or to emit unusual noises, appreciable vibration, excessive heat, or other unfavorable characteristics shall be replaced.
  - c. Defective grease retention seals shall be replaced as needed.

### B. Car Platform (Reuse)

1. The existing platform shall be modified to accommodate the new apparatus specified herein.
  - a. Where necessary, the underside of platform shall be refurbished and treated with fire-rated material.
  - b. Top of platform shall be refurbished with a marine grade plywood set to receive new finished floor covering as selected by Owner.
  - c. At Contractor's option or when conditions warrant, provide a totally new platform in lieu of repairs, modifications and upgraded specified above.
  
- C. Automatic Leveling / Releveling / Positioning Device (New - All Passenger Elevators)
  1. Equip the elevator with a floor leveling device which shall automatically bring the car to a stop within 1/4" of any floor for which a stop has been initiated regardless of load or direction of travel.
  2. This device shall also provide for releveling which shall be arranged to automatically return the elevator to the floor in the event the elevator should move below or above floor level in excess of 1/4".
  3. This device shall be operative at all floors served and whether the hoistway or car door is open or closed provided there is no interruption of power to the elevator.
  4. A positioning device shall be part of the controller microprocessor systems.
    - a. Position determination in the hoistway may be through fixed tape in the hoistway or by sensors fitted on each driving machine to encode and store car movement.
    - b. Design the mechanical features and electrical circuits to permit accurate control and rapid acceleration and retardation without discomfort.
  
- D. Top-of-Car Inspection Operating Station (New)
  1. An inspection operating station shall be provided on top of the elevator car.
  2. This station shall be installed so that the controls are plainly visible and readily accessible from the hoistway entrance without stepping on the car.
  3. When the station is operational, all operating devices in the car shall be inoperative.
  4. Provide the following control devices and features:



- a. A push/pull or toggle switch designated "EMERGENCY STOP" shall be arranged so as to prevent the application of power to the motor or machine when in the "off" position.
- b. A toggle switch designated "INSPECTION" and "NORMAL" to activate the top of car Inspection Service Operation.
- c. Push button designated "Up", "Down" and "Enable" to operate the elevator on Inspection Service (the "Enable" button shall be arranged to operate in conjunction with either the "Up" or "Down" button).
- d. An indicator light and warning buzzer that are subject to activation under Phase I - Fire Emergency Recall Operation.

E. Emergency Exits / Top and Side

1. Ensure they operate as per code and have proper electrical contacts and mechanical locks on the exterior of the cab enclosure.
2. No other key to the building shall unlock the emergency exit lock except access switch keys which may be keyed alike.
  - a. Keys shall be assigned in accordance with ASME A17.1 Group 1 Security requirements.

F. Car Enclosure Work Light (LED)/ Receptacle (New)

1. The top and bottom of each car shall be provided with a permanent lighting fixture and 110 volt GFI receptacle.
2. Light control switches shall be located for easy accessibility from the hoistway entrance.
3. Where sufficient overhead clearance exists, the car top lighting fixture shall be extended no less than 24" above the crosshead member of the car frame.
4. LED Light bulbs shall be guarded so as to prevent breakage or accidental contact.

G. Master Door Power Operator System - VVVF/AC (New)

1. Provide a heavy-duty master door operator on top of the elevator car enclosure for power opening and closing of the cab and hoistway entrance door panels.
2. Operator shall utilize an alternating current motor, controlled by a variable voltage, variable frequency (VVVF) drive and a closed-loop control with programmable operating parameters.
  - a. System may incorporate an encoder feedback to monitor positions with a separate speed sensing device or an

encoderless closed-loop VVVF-AC control to monitor motor parameters and vary power applied to compensate for load changes.

3. The type of system shall be designated as a high speed operator, designed for door panel opening at an average speed of 2.0 feet per second and closing at approximately 1.0 foot per second.
  - a. Reduce the closing speed as required to limit kinetic energy of closing doors to within values permitted by ASME A17.1 as may be adopted and/or modified by the AHJ.
4. The door shall operate smoothly without a slam or abrupt motion in both the opening and closing cycle directions.
  - a. Provide controls to automatically compensate for load changes such as:
    - 1) Wind conditions (stack effect)
    - 2) Use of different weight door panels on multiple landings
    - 3) Other unique prevailing conditions that could cause variations in operational speeds.
  - b. Provide nudging to limit speed and torque in conjunction with door close signaling/closing and timing devices as permitted by ASME A17.1 as may be adopted and/or modified by the AHJ. Nudging shall be initiated by the signal control system and not from the door protective device.
5. In case of interruption or failure of electric power from any cause, the door operating mechanism shall be so designed that it shall permit emergency manual operation of both the car and corridor doors only when the elevator is located in the floor landing unlocking zone.
  - a. The hoistway door shall continue to be self-locking and self-closing during emergency operation.
  - b. The door operator and/or car door panel shall be equipped with safety switches and electrical controls to prevent operation of the elevator with the door in the open position as per ASME A17.1 Code Standards.
  - c. Provide zone-lock devices as required by ASME A17.1 as may be adopted and/or otherwise modified by the AHJ.
6. Construct all door operating levers of heavy steel or reinforced extruded aluminum members, designed for stress

and forces imposed on the related parts, linkages and fixed components during normal and emergency operation functions.

a. All pivot points shall have either ball or roller-type bearings, oilite bronze bushings or other non-metallic bushings of ample size.

7. Provide operating data / data tag permanently attached to the operator as required by applicable code and standards.

H. Car Door Panel(s) (New)

1. Provide standard 1" thick, 14 gauge hollow metal flush construction panel(s), reinforced for power operation and insulated for sound deadening.

2. Paint the hoistway side of each panel black and face the cab side with 16 gauge sheet steel matching the existing returns or in selected material and finish as otherwise directed by Owner/Owner.

3. The panels shall have no binder angles and welds shall be continuous, ground smooth and invisible.

4. Drill and reinforce panels for installation of door operator hardware, door protective device, door gibs, etc.

a. Provide each door panel with two removable laminated plastic composition guides, arranged to run in the sill grooves with minimum clearance.

b. The guide mounting shall permit their replacement without removing the door from the hangers.

5. Provide the meeting edge of center opening doors with necessary continuous rubber astragal bumper strips.

a. These strips shall be relatively inconspicuous when the doors are closed.

I. Door Reopening Device / "3D" (New)

1. Provide a combination infrared curtain and 3D door protection system.

2. The door shall be prevented from closing and will reopen when closing if any one of the curtain light rays is interrupted or should an object enter the 3D detection zone.

3. The door shall start to close when the protection system is free of any obstruction.

4. The infrared curtain and 3D zone protective system shall provide:

- a. Protective curtain field not less than 71" above the sill.
  - b. 3D protective zone field not less than 61" above the sill.
  - c. Accurately positioned infrared lights to conform to the requirements of the applicable handicapped code.
  - d. Modular design to permit on board test operation and replacement of all circuit boards without removing the complete unit.
  - e. Self-contained, selectable 3D zone timeout feature to allow for closing at nudging speed with audible signal.
  - f. Automatic turning-off of the 3D zone in the event of three (3) consecutive 3D triggers.
    - 1) Light curtain shall continue to operate after 3D system timeout.
  - g. Selectable control of the 3D zone operation on an "always-on" or "as doors close" basis.
  - h. Controls to shut down the elevator when the unit fails to operate properly.
5. Existing infrared door protection system, designed in accordance with the criteria specified herein, may be retained and refurbished for new subject to the Government's review and approval.

## 2.9 FINISH AND MATERIALS

### A. Hoistway Entrances Finish and Design

1. Hoistway entrances and door panels shall be finished as shown on the project drawings.
2. Where no finish is specified, finishes shall be baked enamel primer gray.
3. Refer to specifications for other design requirements.

### B. Car Interior Finishes

1. Car interior finishes shall be as shown on the project drawings.
2. Contractor shall provide samples of finishes as required for approval prior to fabrication.
3. Refer to specifications for other design requirements.
4. Special attention shall be given to flooring materials and suitability for intended duty.

### C. Material, Finishes and Painting

1. General

- a. Cold-rolled Sheet Steel Sections: ASTM A366, commercial steel, Type B
- b. Rolled Steel Floor Plate: ASTM A786
- c. Steel Supports and Reinforcement: ASTM A36
- d. Aluminum-alloy Rolled Tread Plate: ASTM B632
- e. Aluminum Plate: ASTM B209
- f. Stainless Steel: ASTM A167 Type 302, 304 or 316
- g. Stainless Steel Bars and Shapes: ASTM A276
- h. Stainless Steel Tubes: ASTM A269
- i. Aluminum Extrusions: ASTM B221
- j. Nickel Silver Extrusions: ASTM B155
- k. Bronze Sheet: ASTM B36 (36M) alloy UNS No. C2800 (Muntz Metal)
- l. Structural Tubing: ASTM A500
- m. Bolts, Nuts and Washers: ASTM A325 and A490
- n. Laminated / Safety Tempered Glass: ANSI Z97.1

2. Finishes

- a. Stainless Steel
  - 1) Satin Finish: No. 4 satin, long grain
- b. Sheet Steel:
  - 1) Shop Prime: Factory-applied baked on coat of mineral filler and primer
  - 2) Finish Paint: Two (2) coats of low sheen baked enamel, color as selected by the Owner.
  - 3) Steel Equipment: Two (2) coats of manufacturers' standard rust-inhibiting paint to exposed ferrous metal surfaces in both the hoistway and pit that do not have galvanized, anodized, baked enamel, or special Architectural finishes.

3. Painting

- a. Apply two (2) coats of paint to the machine room floor.
- b. Apply two (2) coats of clear lacquer to bronze or similar non-ferrous materials to prevent tarnishing during a period of not less than twelve (12) months after initial acceptance by the Owner or Agent.
- c. Identify all equipment including buffers, crosshead, safety plank, machine, controller, drive, governor, disconnect switch, etc., by 4" high numerals which shall contrast with the background to which it is applied. The identification shall be either decalcomania or stencil type.

- d. Paint or provide decal-type floor designation not less than six (6) inches high on hoistway doors (hoistway side), fascias and/or walls as required by A17.1 Rule 100.7 at intervals not exceeding 7'-0". The color of paint used shall contrast with the color of the surface to which it is applied.

D. Designation and Data Plates, Labeling and Signage

1. Provide an elevator identification plate on or adjacent to each entrance frame where required by the AHJ.
  - a. The designation numeral shall be a minimum of 3" in height.
2. Provide floor designation plates at each elevator entrance, on both sides of the jamb at a height of 60 inches to center line of plate.
  - a. Floor number designations and Braille shall be 2" high, 0.03" raised and stud mounted.
3. Provide raised designations and Braille markings to the left of the car call and control buttons of the car operating panel(s).
  - a. Designations shall be a minimum of 5/8" high, 0.03" raised and stud mounted.
4. Provide elevators with data and marking plates, labels, signages and refuge space markings complying with A17.1 Elevator Safety Code as may be adopted and/or otherwise modified by the AHJ.
5. Owner shall select the designation and data plates from manufacturer's premium line of plates.

2.10 FIXTURES / SIGNAL EQUIPMENT

A. General - Design and Finish

1. The design and location of the hall and car operating and signaling fixtures shall comply with the ADAAG.
2. The operating fixtures shall be selected from the manufacturer's premium line of fixtures. Buttons shall be illuminated using ultra-bright white LED's.
3. The operating fixtures for the Service Elevators 5 & 6 will be selected from the manufacturer's premium line of vandal resistant fixtures.

4. A working sample of the fixture buttons will be provided to the owner and VDA, prior to production.
5. Custom designed operating and signaling fixtures shall be as shown on the drawings or as approved by the Owner/VDA.
6. Custom designed operating and signaling fixtures shall be as shown on the drawings or as approved by the Owner / Owner.
7. The layout of the fixtures including all associated signage and engraving shall be as approved by the Government and the VA Owner's Representative.
8. Where no special design is shown on the drawings, the buttons shall be as follows:

a. Passenger Elevators

- 1) Typical Floors: 1/8" thick stainless steel faceplate with No. 4 finish.
  - 2) Ground Floor: Custom designed stainless steel faceplate with No. 4 finish.
9. Mount passenger elevator fixtures with tamperproof or concealed fasteners and service elevator fixtures with tamperproof screws. The screw and key-switch cylinder finishes shall match faceplate finish.
  10. Where key-operated switch and or key-operated cylinder locks are furnished in conjunction with any component of the installation, four (4) keys for each individual switch or lock shall be furnished, stamped or permanently tagged to indicate function.
  11. All caution signs, code mandated instructions and directives shall be engraved and filled with epoxy.

B. Main Car Operating Panel (New)

1. Provide a main car operating push button panel on the inside front return panel of the car.
2. Car operating panel shall be flush mounted with swing type, one-piece faceplate with heavy-duty concealed hinges.
  - a. Mount all key switches that are required to operate and maintain the elevators exposed on the car station except those specified within a locked service cabinet.
3. The push buttons shall become individually illuminated as they are pressed and shall extinguish as the calls are answered.
4. The operating panel shall include:
  - a. A call button for each floor served.
  - b. "Door open" / "Door close" buttons.

- c. Adjustable "Door Hold" button with range of 10 seconds to 99 seconds.
  - d. "Alarm" button (Interfaced with emergency alarm).
  - e. Full speech voice annunciator capabilities.
  - f. "Emergency Stop" switch per local law.
  - g. Self-dialing, hands-free telephone and/or intercom with call acknowledging feature and ADA design provisions.
  - h. Firefighters' telephone jack and emergency communication provisions, as required per local code.
  - i. Interactive security features utilizing a card reader system, provided by this contractor.
  - j. Code blue "in-car" key switch and visual indicator signal with audible alarm. The signage will use "medical emergency" in the signal indicators.
  - k. Locked Firemen's Service cabinet, keyed in accordance with local Code, containing required devices (including fire phone jacks) and signals in accordance with ASME A17.1 Standards.
  - l. Automatic opening of the locked cabinet door may be provided with signals initiated by the fire detection and alarm system where approved by the Authority Having Jurisdiction.
5. Provide a locked service cabinet flush mounted and containing the key switches required to operate and maintain the elevator, including, but not limited to:
- a. Independent/Attendant service switch with associated operating buttons and signal indicators.
  - b. Light switch.
  - c. Fan switch.
  - d. G. F. I. duplex receptacle.
  - e. Emergency light test button and indicator.
  - f. Inspection Service Operation key switch.
  - g. Port for hand-held service tool where applicable.
  - h. Dimmer for cab interior lighting.
6. Car operating panel shall incorporate:
- a. An integral (no separate faceplate) digital L.E.D. floor position indicator
  - b. Emergency light fixture (without a separate faceplate) and black-filled engraved unit I.D. number or other nomenclature, as approved by Owner
  - c. A "No Smoking" advisory and the rated passenger load capacity.
7. Provide a dedicated space within the car operating panel for a proximity card reader device to disconnect the corresponding floor push button. Design and location to be



determined by owner and Government. Engraving, as approved by the owner, will be included in the card space designations. A removable flush mount face plate shall be integrated in the main car operating panel, with final design as approved by the owner. Any required mounting provisions will be included in the panel for existing and future applications.

8. Equip the car operating panel with security car call keyed switches OR proximity card reader to disconnect the corresponding floor push button.
  - a. Security system shall be overridden by Phase II Firefighter's Emergency Operations in accordance with code.
9. Where posting of an advisory is permitted by the Governing Authority in lieu of the inspection certificate, engrave the following advisory on the hinged cover of the service cabinet, or where otherwise directed by the Owner.
  - a. Elevator Certificate is On File in Building Management Office.

C. Car Position Indicator

1. The position of the car in the hoistway shall be indicated by the illumination of the position indicator numeral corresponding to the floor at which the car has stopped or is passing.
  - a. Provide 2" high, 10-segment LED type position indicator with direction arrows, integral with the car operating panel.
  - b. Provide Lexan cover lens with hidden support frame behind fixture plate to protect the indicator readout.
  - c. Provide audible floor passing signal per ADA standards where not provided by the elevator signal control.
  - d. Flush mount fixture with cover to match selected car front or car operating panel finish as directed by the Owner.

D. Voice Annunciator (Speech)(New)

1. Provide a voice annunciator in each elevator.
2. Coordinate size, shape and design with Designer and other trades.
3. The system shall include, but not limited to:
  - a. Solid state digital speech annunciator
  - b. A recording feature for customized messages

- c. Male and female voice capabilities
  - d. Playback option
  - e. Built-in voice amplifier
  - f. Master volume control
  - g. Audible indication for selected floor, floor status or position, direction of travel, floor stop and nudging.
4. Locate all associated equipment in a single, clearly labeled enclosure located either in the machine room and/or on car top.
- E. Corridor Push Button Stations / Riser (New - Match Existing Conditions)
1. A riser of push button signal fixtures shall be provided on all floors.
  2. Each signal fixture shall consist of the following:
    - a. A flush-mounted faceplate.
    - b. Illuminating tamper-resistant push buttons measuring 3/4" at their smallest dimension as selected by the Owner.
    - c. A recessed mounting box, electrical conduit and wiring.
  3. Intermediate landings shall be provided with fixtures containing two (2) push buttons while terminal landings shall be provided with fixtures containing a single push button.
  4. Include firefighter key switch in the main lobby level station or other designated recall landing.
  5. Push button signal fixtures shall be installed at a centerline height of 42" above the floor and shall be installed both plumb and flush to the finished wall.
  6. Provide a digital floor position indicator with 2" high numerals at all landings served.
  7. All cutting, patching, grouting and/or plastering of masonry walls resulting from the removal or installation of corridor fixtures shall be performed by the Contractor so as to maintain the fire rating of the hoistway.
    - a. Finished painting or decorating of wall surfaces shall be by contractor.
  8. All faceplates shall be engraved with fire logo and "In Case of Fire Use Stairs" to help fill the void created by the use of oversized covers.
- F. Hall Direction Lanterns / Floor Position Indicator at Basement and 1<sup>st</sup> floor.

1. Provide a visual and audible signal at each entrance to indicate the direction of travel and, where applicable, which car shall stop in response to the hall call.
  - a. Design the lantern with up and down indication at intermediate landings and a single indication at terminal landings.
  - b. Lanterns shall sound once for the up direction and twice for the down direction.
    - 1) Provide an electronic chime with adjustable sound volume.
  - c. Provide adjustable signal time (3 to 10 seconds, with 1 second increments) to notify passengers which car shall answer the hall call and preset per ADAAG distance standards.
2. All floors shall include a fixture that shall incorporate a 2" high LED floor position indicator in the hall lantern fixture with direction arrows located on both sides of the indicator.
3. Locate the lantern above / adjacent to the corridor entrance. Final location to be determined by owner.

G. Hoistway Access Switch (New)

1. Install a cylindrical type keyed switch at top terminal in order to permit the car to be moved at slow speed with the doors open to allow authorized persons to obtain access to the top of the car.
2. Where there is no separate pit access door, a similar switch shall be installed at the lowest landing in order to permit the car to be moved away from the landing with the doors open in order to gain access to the pit.
3. Locate the switch in the terminal floor entrance jambs without faceplate at a height of 78" above the finished floor in existing locations, as applicable. Existing key switches will be replaced with new assemblies in this application.
4. Locate the switch in a separate fixture with a flush cover plate at a height of 78" above the finished floor in non-jamb existing installations. Cover plate shall be of a design and style as approved by the Owner, the Owner's representative or Owner.
5. For simplex / duplex installations, locate the switch in the hall call push button station at the top and bottom terminal landings where required if allowed by the Authority Having Jurisdiction.

6. This switch is to be of the continuous pressure spring-return type and shall be operated by a cylinder type lock having not less than a five (5) pin or five (5) disc combination with the key removable only in the "OFF" position.
  - a. The lock shall not be operable by any key which operates locks or devices used for other purposes in the building and shall be available to and used only by inspectors, maintenance men and repairmen in accordance with A17.1 applicable Security Group.
7. Existing provisions that meet the aforementioned criteria may be updated with keyed switches to match new apparatus provided for uniformity of systems within the building.

H. Lobby Control Panel (New)

1. Provide a Lobby Control Panel for elevators located in the fire command security station, and fire command room as directed by the Owner.
2. Provide stainless steel faceplate with tamperproof screws.
3. The panel shall include:
  - a. 2" high LCD car position and travel direction indicators.
  - b. Master intercom station / telephone.
  - c. Three (3) position (on/car to lobby/off) switches.
  - d. Emergency power controls and indicators as per code requirements.
  - e. "Car at the designated floor with its doors open" indicator.
  - f. System trouble indications.
  - g. Car call floor lockout switches.
  - h. Floor lockout switches as herein further specified.
  - i. Car to lobby key switches.

I. Lift-Net Elevator Management Information System (New - All Elevators)

1. The data collection, data storage and real-time monitoring portion of the system shall be based on Microsoft Windows, and able to run on Windows 7 or later operating systems.
2. The system shall:
  - a. Be network-based and be capable of interfacing with all makes and types of elevator control systems.
  - b. Collect data via either serial data link or hardwired interface connections.
  - c. Be capable of operating on any TCP/IP based network system including but not limited to Ethernet, Token Ring, Arc-net and Lift-Net.
  - d. Allow the addition of unlimited monitoring terminals on the network.
3. Monitoring terminals shall operate "peer to peer" without a single server, and the failure of a single network device shall not affect the operation of the rest of the system.
4. The system shall provide multiple banks, including multiple buildings, on a single monitoring terminal screen.
5. All monitored banks shall be visible from any monitoring terminal on the network.
6. Entry into the network shall be multi-level password protected.
  - a. The system shall be capable of real time display of all monitored status points on all monitored equipment.
  - b. Fault and event notification screens and audible alarms shall be immediately displayed on selected monitoring stations.
  - c. Different fault and event tables shall be defined on a per-bank basis.
  - d. The system shall collect and store all status, fault and event information for later reporting and analysis.
  - e. The system shall provide statistical analysis of hall call response times, traffic patterns, fault conditions, service logs and security usage in graphical and tabular format.
  - f. The system shall maintain a record of every status point change occurring on the monitored equipment, and provide the ability to replay these events in a simulation at a later time in real time, slow speed, single step, reverse, or fast forward.
    - 1) This information shall be retained for a period of at least twenty-six weeks, and a mechanism shall

be provided whereby this information may be archived.

- g. The system shall store traffic, fault and statistical data for a period of at least three (3) years.
    - 1) The system shall log error type, car number, floor position and major system status points whenever a fault or logged event occurs.
  - h. The system shall provide interactive control of certain features provided in the elevator control system which may be revised as the requirements of the building change.
  - i. Interactive controls shall include but are not limited to:
    - 1) Security floor lockouts
    - 2) Entering car and hall calls
    - 3) Firefighter's return service
    - 4) Lobby recall
    - 5) VIP service
    - 6) Suspicious person / security return
    - 7) Up/Down peak
    - 8) Hospital Code Blue service (per local codes). Local codes may affect the availability or operation of these features.
  - j. In the case of a power failure the system shall be capable of connecting to an emergency power back-up unit without the loss of any stored data.
7. The system will automatically re-boot the program and continue to operate after a power loss or other system malfunction.
8. The Elevator Monitoring Equipment shall have the following minimum characteristics:
- a. Monitoring Station Hardware
    - 1) Central processing unit - IBM compatible microcomputer - desk top or mini-tower (multiple machine rooms or lobby displays)
    - 2) Type - Pentium or most current high-performance processor
    - 3) Speed - most current high-performance
    - 4) Internal hard drive - adequate storage for three years data for entire system
    - 5) Modem - most current high-performance

- 6) Display - color, capable of simultaneous display of all monitored units
- 7) Printer - current HP Color Desk Jet Series
- 8) Keyboard - MS Windows compatible
- 9) Mouse - MS Windows compatible
- 10) Power requirements - 90 - 230 Volts AC 50 - 60Hz

b. Machine Room Hardware

- 1) Controller interface panels with high quality printed circuit boards
- 2) Input voltage range - 5 - 250V AC/DC
- 3) Compatible with all types and makes of controllers
- 4) Operating temperature range - 45 - 112 degrees Fahrenheit
- 5) Humidity range - 10% - 85% non-condensing
- 6) Modular design - capable of future expansion
- 7) Power requirements - 90 - 230 VAC 50 - 60Hz @ 3A

9. The system shall display and record the following information for each monitored unit: The following is intended as a guideline - connections to each status point mentioned on every control system may be impractical. Serial data links may include many more points.

- a. Group operational mode
- b. Multiple groups or buildings on the same screen
- c. In/out of service
- d. In/out of group service
- e. Emergency power
- f. Supervisory failure
- g. Location and direction of hall calls
- h. Individual car status - expandable menus
- i. Direction of travel
- j. Independent service
- k. Inspection service
- l. Fire service
- m. Position of elevator
- n. Door status (open, opening, closing, closed)
- o. Door dwell time
- p. Load by-pass
- q. Emergency power
- r. Power on/off
- s. Door detector
- t. Safety circuit
- u. Door zone
- v. Stop switch
- w. Alarm button
- x. Registered Car Calls

10. Keyboard, Mouse and time clock control capabilities
  - a. Floor lockouts (car or hall)
  - b. Lobby recall
  - c. VIP service
  - d. Firefighter's service
  - e. Hospital Code Blue
  - f. Up/Down Peak
  - g. User defined parameters (minimum eight (8) inputs)
11. Faults monitored with visual and audible alarm, triggered by combinations of any of the above status points
  - a. Safety circuit
  - b. Alarm bell
  - c. Door reversal devise
  - d. Earthquake
  - e. At least six user selectable faults or events

J. Security Cameras (Future and existing - All Elevators)

1. Provide all required wiring from a common point (junction box) on the elevator controller in the machine room to a common point (junction box) on the car top. Connect new cameras provided and installed under this contract to this junction box.

K. Emergency Power Control Panel

1. Provide the lobby console or other designated location with a control panel for emergency power operation as further specified.
  - a. An emergency power control panel provided at the designated location.
  - b. The panel shall contain:
    - 1) An indicator light that illuminates when a transfer to emergency power takes place.
    - 2) Indication that the elevators have arrived at the designated landing and have parked with the doors maintained in the open position.
    - 3) Key-operated override switches and a manual selector switches identified with positions for each elevator.
2. The control panel shall be engraved so as to identify the function of each control feature and device provided.



3. The Elevator Contractor shall provide all necessary electrical conduit and wiring between the elevator machine room(s), and the Emergency Power Control Panel.

## 2.11 CAR ENCLOSURES

### A. Elevator Cab

#### 1. Car Shell and Panels

- a. The car sides and rear wall shall be constructed of No. 14 gauge steel. Apply sound-deadening material to the outside face of the shell. Sound deadening material shall be of the rubberized type and shall be of either brush or spray-on consistency. Material shall be applied to a minimum of 1/8" thickness. Side emergency exit, where applicable, shall be provided per local laws.
- b. The car top shall be of no less than No. 12 gauge sheet steel suitably braced to meet the requirements of the A17.1 Code and painted white. Exit shall include hinging and locking arrangements of top emergency door with electrical safety switch to prevent operation with door open.
- c. The transom shall be constructed of 14 gauge metal finished consistent with materials used for the return panels. The wall panels shall be constructed of 3/4" thick marine grade plywood.
- d. Each panel section shall be faced with a selected laminate/veneer or other material and framed in 1/16" thick stainless steel.
- e. Frame members shall be separated by 1/2" thick polished metal trim and fitted with 3-1/2" by 3-1/2" polished metal plates at corners.
- f. Apply furniture steel or suitable laminate to shaft side of panels to prevent warping or other deformations.
- g. Provide a finished metal base with a 1/4" wide continuous vent slot above the base to allow the proper amount of air to infiltrate the cab based on the CFM of the exhaust fan and car interior size.

#### 2. Base:

- a. Provide a finished metal base with a 1/4" wide continuous vent slot above the base to allow the proper amount of air to infiltrate the cab based on the CFM of the exhaust fan and car interior size.

- b. Prepare base to accept finished floor of flexible terrazzo tile, as specified in this document.
3. Entrance Sill (New):
  - a. Provide car door entrance saddle using a nickel-silver sill.
4. Lighting:
  - a. Provide protective covers that allow service/maintenance from inside the cab area and sufficient to provide code-required lighting within the cab. Fixtures to be designed to provide indirect lighting.
5. Flooring:
  - a. Replace any damaged subflooring for acceptance new flooring. Thickness to be determined with the flush mounting requirements of the car sill.
6. Handrail:
  - a. Provide standard 1/2" x 2" polish flat-stock Stainless steel handrail on all walls with top of rail located 32 inches above the finished floor.
  - b. Provide a lower handrail mounted to protect the walls from wheelchair and cart traffic using 1/2" X 6 inch flat stock stainless steel on all walls.
  - c. Use three (3) points of attachment designed for interior access servicing with exterior support plates.
7. Protection Pads:
  - a. Provide floor-to-ceiling vinyl pads for all wall surfaces with associated hanging hardware.
8. Cab Doors: Standard 1" thick, 14 gauge hollow metal flush construction, reinforced for power operation and insulated for sound deadening. Paint hatch side of doors black and face cab side with 16 gauge sheet stainless steel.
  - a. The door panels shall have no binder angles. All welds shall be continuous, ground smooth and invisible.
  - b. Drill and reinforce doors for installation of door operator hardware, door protective device, door gibs, etc.

9. Ceiling: Construction techniques for wall panels shall apply to ceiling panel construction. Locate top emergency exit inconspicuously. Construct and mount the exit panel to prevent light leakage around the perimeter of panel.
10. Ventilation: The ventilation system of the exhaust type shall be provided in each elevator.
  - a. The system shall include a blower driven by a direct connected motor and mounted on top of car with isolation to effectively prevent transmission of vibration to the car structure. The blower shall have not less than two operating speeds. The ventilation system shall be sized to provide one air change per minute at low speed and 1.5 air changes per minute at high speed. The unit design and installation shall be such that the maximum noise level, when operating at high speed, shall not exceed 55 dBA approximately three feet above the car floor. A two-position switch to control the blower shall be provided in the car station.
  - b. The blower shall start upon the pressing of a car or landing call button and shall stop a predetermined time (approximately 2 minutes) after the car has answered the last registered call.
11. Lighting: Arrange LED lighting fixtures and ceiling assembly to provide even illumination without hot spots and shadows. Overlap lamps where cove lighting is specified.
  - a. Design and configure lighting system to facilitate maintenance of the fixtures.
12. Handrails: All attachment hardware shall match the selected handrail and shall permit handrail removal from within the cab.
  - a. Provide a minimum of 10 gauge plate at the hatch side of the shell, aligned with the handrail attachment points, to assure secure handrail mounting.
  - b. Design handrail attachment system to support the weight of a person (250 pounds) sitting on it without any deflection and damage to the handrail, cab panel and the shell.
13. Protective Pads and Pad Hooks: Provide pad hooks at locations as directed by the Owner. Protective pads shall cover the front return panels, and the side and rear walls. Provide cutouts in pads for access to the cab operating and signaling devices. Pads shall be fire-resistant canvas with two (2) layers of cotton batting padding.

- a. Identify each pad by elevator number and wall location.
  - b. Provide storage bags for the pads for each elevator with elevator number plainly marked on the outside.
14. Accessories: Construct elevator cab to accommodate the door operator, hangers, interlocks and all accessory equipment provided under other sections of these specifications, including firefighter phones, card readers and CCTV.
  15. All cab materials shall conform to the code prescribed flame spread rating and smoke development requirements.
- B. Cab Fabrication and Installation
1. Maintain accurate relation of planes and angles with hairline fit of contacting panels and/or surfaces.
  2. Any shadow gaps (reveals) between panels shall be consistent and uniform.
  3. Unless otherwise specified or shown on the drawings, for work exposed to view use concealed fasteners.
  4. Maximum exposed edge radius at corner bends shall be 1/16". There shall be no visible grain difference at the bends.
  5. Form the work to the required shapes and sizes with smooth and even curves, lines and angles. Provide necessary brackets, spacers and blocking material for assembly of the cab.
  6. Interior cab surfaces shall be flat and free of bow or oil canning. The maximum overall deviation between the low and high points of 24" x 24" panel section shall not exceed 1/32".
  7. Make weights of connections and accessories adequate to safely sustain and withstand stresses to which they will be subjected.
  8. All steel work except stainless steel and bronze materials shall be painted with an approved coat of primer and one (1) coat of baked enamel paint.
  9. Canopy: Paint canopy with a coat of primer and one coat of low sheen enamel paint.
  10. Front Return Panels and Transom: Stainless steel fixed type front return panel.
    - a. Provide stainless steel entrance posts having mitered, welded and ground smooth corners.
  11. Cab Doors: Stainless steel with No.4 finish.
  12. Ceiling:
    - a. Suspended ¼" thick white diffuser in stainless steel frame as shown on the drawings.

13. Base: Provide a 4" high base in the material and finish shown on the drawings at the sides and rear of the cab enclosure.
14. Lighting: Arrange LED lighting fixtures and ceiling assembly to provide indirect illumination without hot spots and shadows.
  - a. Design and configure lighting system to facilitate maintenance of the fixtures.

C. Elevator Cab Enclosure Fan

1. Provide an exhaust type multi speed fan unit with cover grill, mounting accessories and necessary cab enclosure modifications.
  - a. Fan unit shall include self-lubricating motor with housing rubber mounted for sound vibration isolation.
2. Provide key switch in the elevator cab enclosure for speed control of the fan unit.
3. Provide necessary wiring and approved conduit to properly connect fan unit with power source and control key switch.

2.12 EMERGENCY LIGHTING / COMMUNICATIONS / SIGNALING

A. Battery Back-Up Emergency Lighting Fixture and Alarm

1. Arrange two (2) of the LED cab light fixtures to operate as the emergency light system.
2. Provide a car-mounted battery unit including solid-state charger and testing means enclosed in common metal container.
  - a. The battery shall be rechargeable nickel cadmium with a 10-year minimum life expectancy. Mount the power pack on the top of the car.
  - b. Provide a 6" diameter alarm bell mounted directly to the battery/charger unit and connected to sound when any alarm push button or stop switch in the car enclosure is operated.
  - c. The bell shall be configured to operate from power supplied by the building emergency power generator. The bell shall produce a sound output of between 80-90 dBa (measured from a distance of 10') mounted on top of the elevator car.

- 1) Activation of this bell shall be controlled by the stop switch and alarm button in the car operating station
  - 2) The alarm button shall illuminate when pressed.
3. Where required by Code for the specific application, the unit shall provide mechanical ventilation for at least one (1) hour.
  4. The operation shall be completely automatic upon failure of normal power supply.
  5. Unit shall be connected to normal power supply for car lights and arranged to be energized at all times so it automatically recharges battery after use.

B. Common Alarm Bell

1. Provide a common alarm bell located in the elevator pit.
  - a. The bell shall be configured to operate when the alarm or stop switch of any elevator is activated, during both normal and battery back-up power conditions.
  - b. Existing common alarm bells may be rehabilitated and reused providing they meet the intent of this section and applicable codes.

C. Emergency Voice Communication / Telephone (New - All Elevators)

1. A hands-free emergency voice communication system shall be furnished in each car mounted as an integral part of the car operating panel.
  - a. Necessary wires shall be included in the car traveling cable and shall consist of a minimum of one shielded pair of 20AWG conductors.
  - b. 120V power shall be provided to power the hands-free device.
2. The telephone shall be equipped with an auto-dialer and illuminating indicator which shall illuminate when a call has been placed and begin to flash when the call has been answered.
  - a. Engraving shall be provided next to the indicator which says "When lit help is on the way".
3. In addition to the standard "Alarm" button, a separate activation button shall be provided on the car operating panel to initiate the emergency telephone and place a call.

- a. The telephone must not shut off if the activating button is pushed more than once.
  - b. The telephone shall transmit a pre-recorded location message only when requested by the operator and be provided with an adjustable call time which can be extended on demand by the operator.
  - c. Once two-way communication has been established, voice prompts shall be provided which instruct the operator on how to activate these functions as well as alerting the operator when a call is being attempted from another elevator in the building.
4. The system shall be compatible with ring down equipment and PBX switchboards.
  5. The system shall be capable of serving as the audio output for an external voice annunciation system.
    - a. Conversation levels shall measure 60 dbA or higher and measure 10 dbA above ambient noise levels.
    - b. Each device shall be provided with a self-diagnostic capability in order to automatically alert building personnel should an operational problem be detected.
  6. The phone shall be able to:
    - a. Receive incoming calls from any On-Site Rescue Station (when provided or required).
    - b. Receive incoming calls from other off-site locations via the public telephone system.
    - c. Acknowledge incoming calls and automatically establishing hands-free two way communications.
      - 1) If no On-Site Rescue Station is provided, each hands-free device shall have built in line consolidation which will allow up to 6 elevators to be called individually from outside the building over a single telephone line and up to 80 elevators if an On-Site Rescue Station is provided.
  7. The emergency elevator communication system shall require a maximum of one telephone line.
    - a. The system must provide line sharing capability to eliminate the need for a dedicated telephone line.
    - b. The line sharing function must ensure that the emergency telephones always receive dialing priority even if the line is in use and that the emergency telephones can be called into from an off-site location.

8. The system shall provide its own four hour backup power supply in case of a loss of regular AC power.
9. The system must provide capability for building personnel to call into elevators and determine the charge state of any backup batteries provided for the emergency telephones.
10. Pushing the activation button in any of the elevator car stations will cause any on-site Rescue Station (where provided or required) or security telephone to ring.
  - a. If the on-site call is not picked up within 30 seconds, the call will be automatically forwarded to a 24 hour monitoring station. Number to be provided by the COR.
11. All connections from the junction box to the telephone system shall be done by the Elevator Contractor where existing provisions can be reused.
12. New telephone lines, where required, shall be provided and interfaced by this contractor.
13. All connections from the junction box to the security room's main telephone system shall be done by this contractor.
14. All electrical work shall conform to Division 16 requirements.

D. Central Exchange Communication System / Intercom (EMS5)

1. Provide an ADA compatible, hands-free intercommunication system for all elevators for two-way, multi-path communication between the elevator car stations and master stations using a central exchange design system.
2. The communication system shall include:
  - a. A car station in each elevator.
  - b. A master station in each machine room to communicate with the central and satellite monitor panels, and with each car within its group.
  - c. A master station in the Engineers Room to communicate with all stations in the system.
  - d. A master station located in the fire command room.
3. The car station shall have a loudspeaker and a microphone to provide hands-free communication. The station shall be installed behind the car operating panel.
4. Master stations shall include:
  - a. Selector push buttons
  - b. Annunciator lights for each connected station
  - c. Speaker/microphone
  - d. Volume control and function buttons.



5. Install one master station in the remote monitoring panel with other master stations being the desk-mount type.
6. The master stations shall communicate with other master stations and any elevator in that group.
7. A call shall be placed from the elevator car station by pressing the emergency call or alarm button.
  - a. This action shall cause the lamp in the corresponding button of all the designated master stations to flash and an intermittent tone to be heard.
  - b. When the incoming call is answered, the flashing light shall go to a steady condition.
  - c. Disconnection of a call is simply done by depressing the designated car button once.
  - d. If a call request is placed during a conversation, it shall be indicated by a flashing light and short tone of every designated master station.
  - e. When the original conversation is completed, the normal intermittent tone shall resume.
8. A master station shall be connected to any of its designated car stations by depressing the corresponding call button.
  - a. The lamp in the button shall be illuminated while the button is depressed.
  - b. In the car station an audible tone shall be emitted and immediate communication is established.
  - c. The call shall be ended by depressing the button a second time, disconnecting the circuit.
  - d. The master stations shall call any other master station by depressing the corresponding call button.
  - e. The button shall lock in its down position and the lamp shall be lit with a steady light.
  - f. At the called master station, a short tone shall be sent out and the lamp in the button corresponding to the "calling" party shall be lit.
  - g. After the tone, immediate communication is established.
9. On all non-called master stations, the lamps corresponding to the calling and called stations shall be illuminated as an indication that those stations are busy.
10. Provide all power supplies, wire, conduit, fittings, etc., for both systems.
11. Location of the stations, in the specified rooms or areas, shall be directed by the Owner.
12. The intercom system shall include the following features:
  - a. Test button to verify audio circuit path.

- b. All call buttons to initiate a call to all cars in the systems.
  - c. Priority button in the remote monitoring panel stations.
  - d. Visual acknowledgment for the hearing impaired.
13. Provide a battery backup power supply for the intercom capable of providing sufficient power to operate the complete system for a minimum of four (4) hours.
- E. Firefighters' Two-Way Telephone Communications System
- 1. Provide a complete two-way telephone communications system for point-to-point communications between authorized personnel.
  - 2. Provide firefighter telephone jack in the car operating panel in accordance with the requirements of the local authorities. The box shall be fitted with a flush mounted door having hairline joints.
  - 3. Connection devices (jacks) and all associated wiring shall be provided by the elevator Contractor as part of the base bid.
  - 4. The handsets shall be self-powered and not require an external power source for operation.
    - a. The existing firefighter phone shall be reused.
- F. Life Safety System / Hospital Intercom (Reuse Existing)
- 1. Install Life Safety System speaker in each elevator cab.
  - 2. Provide all necessary wiring and interfacing between the elevator system and the Life Safety System as required.
  - 3. The Life Safety System speaker shall be furnished under Division 16.

**PART 3 - EXECUTION**

3.1 EXAMINATION

A. Inspection

1. Study the Contract Documents with regard to the work as specified and required so as to ensure its completeness.
2. Examine surface and conditions to which this work is to be attached or applied and notify the Owner in writing if conditions or surfaces are detrimental to the proper and expeditious installation of the work. Starting the work shall imply acceptance of the surfaces and conditions to perform the work as specified.
3. Verify, by measurements at the job site, dimensions affecting the work. Bring field dimensions which are at variance with those on the accepted shop drawings to the attention of the Owner. Obtain the decision regarding corrective measures before the start of fabrication of items affected.
4. Cooperate in the coordination and scheduling of the work of this section with the work of other sections so as not to delay job progress.

3.2 INSTALLATION

A. Installation

1. Modernize the elevators, using skilled personnel in strict accordance with the final accepted shop drawings and other submittals.
2. Comply with the code, manufacturer's instructions and recommendations.
3. Coordinate work with the work of other building functions for proper time and sequence to avoid delays and to ensure right-of-way of system. Use lines and levels to ensure dimensional coordination of the work.
4. Accurately and rigidly secure supporting elements within the shaftways to the encountered construction within the tolerance established.
5. Provide and install motor, switch, control, safety and maintenance and operating devices in strict accordance with the submitted wiring diagrams and applicable codes and regulations having jurisdiction.
6. Ensure sill-to-sill running clearances do not exceed 1 ¼" at all landings served.
7. Arrange door tracks and sheaves so that no metal-to-metal contact exists.

8. Reinforce hoistway fascias to allow not more than 1/2" of deflection.
9. Install elevator cab enclosure on platform plumb and align cab entrance with hoistway entrances.
10. Sound isolate cab enclosure from car structure. Allow no direct rigid connections between enclosure and car structure and between platform and car structure.
11. Isolate cab fan from canopy to minimize vibration and noise.
12. Remove oil, dirt and impurities and give a factory coat of rust inhibitive paint to all exposed surfaces of struts, hanger supports, covers, fascias, toe guards, dust covers and other ferrous metal.
13. Prehang traveling cables for at least 24 hours with ends suitably weighted to eliminate twisting after installation.
14. Pack openings around oil line with fire resistant, sound isolating glass or mineral wool.
15. Provide isolation pad between platen head and car structure.
16. Set jack unit plumb in waterproof hole and bolt it to mounting channels in the pit.
17. Sound isolate pump units and controllers from building structure.
18. After installation, touch up in the field, surfaces of shop primed elements which have become scratched or damaged.
19. Lubricate operating parts of system as recommended by the manufacturer.

B. Removal of Elevators

1. Shall be coordinated with the COR to minimize inconvenience to owner's operation.
2. A minimum of five (5) days advance written notice shall be given to the Owner and Elevator Consultant by the Contractor detailing the reasons for the simultaneous removal of the elevators from service along with the estimated out-of-service time.
3. The request shall be subject to review by the Government and approved by the Owner prior to the commencement of the work.
4. Costs for this work in addition to associated expenses shall be included as part of the base bid pricing.

C. Transfer of Hall Button Risers

1. Transfer of the hall button riser(s) to the new signal control systems shall be performed on a not-to-interfere basis and shall not interrupt building operations or inconvenience building occupants.

2. Costs for this work in addition to associated expenses shall be included as part of the base bid pricing. (including overtime if needed)

### 3.3 FIELD QUALITY CONTROL

#### A. Inspection and Testing

1. Upon completion of each work phase or individual elevator specified herein, the Contractor shall, at its own expense, arrange and assist with inspection and testing as may be required by the VA.

#### B. Substantial Completion

1. The work shall be deemed "Substantially Complete" for an individual unit or group of units when, in the opinion of the Government, the unit is complete, such that there are no material and substantial variations from the Contract Documents, and the unit is fit for its intended purpose.
2. Governing authority testing shall be completed and approved in conjunction with inspection for operation of the unit; a certificate of operation or other required documentation issued; and remaining items mandated for final acceptance completion are limited to minor punch list work not incorporating any life safety deficiencies.
3. The issuance of a substantial completion notification shall not relieve the Contractor from its obligations hereunder to complete the work.
4. Final completion cannot be achieved until all deliverables, including but not limited to training, spare parts, manuals, and other documentation requirements, have been completed.

#### C. Contractor's Superintendent

1. The Contractor shall assign a competent project superintendent during the work progress and any necessary assistant, all satisfactory to the Owner. The superintendent shall represent the Contractor and all instructions given to him shall be as binding as if given to the Contractor.
2. In accordance with RAF 52.236-6, at all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the worksite a competent superintendent who is satisfactory to the Contracting Officer and has authority to act for the Contractor.

### 3.4 PROTECTION / CLEANING

#### A. Protection and Cleaning

1. Adequately protect surfaces against accumulation of paint, mortar, mastic and disfiguration or discoloration and damage during shipment and installation.
2. Upon completion, remove protection from finished surfaces and thoroughly clean and polish surfaces with due regard to the type of material. Work shall be free from discoloration, scratches, dents and other surface defects.
3. The finished installation shall be free of defects.
4. Before final completion and acceptance, repair and/or replace defective work, to the satisfaction of the Owner, at no additional cost.
5. Remove tools, equipment and surplus materials from the site.
6. Any existing material that is not used for the modernization project is to be removed before the final completion, including all material currently located in the machine room, hoistways, secondary spaces and pits.

#### B. Barricades and Hoistway Screening

1. The Contractor shall provide barricades where necessary in order to maintain adequate protection of areas in which work specified by the Contract Documents is being performed, including open hoistway entrances. Fabrication and erection as all barricades shall be in compliance with applicable OSHA regulations.
2. As required, the Contractor shall provide temporary wire mesh screening in the hoistway and of any elevator undergoing work specified in the Contract Documents. This screening shall be installed in such a manner as to completely segregate the hoistway from that of adjacent elevators. Screening shall be constructed from .041" diameter wire in a pattern that rejects passage of a 1" diameter ball.

### 3.5 DEMONSTRATION

#### A. Performance and Operating Requirements

1. Passenger elevators shall be adjusted to meet the following performance requirements:
  - a. Speed: within 5% of rated speed under any loading condition.
  - b. Leveling: within 1/4" under any loading condition.

c. Door Operating Times:

Door Type	Opening	Closing
42" x 84" center opening	1.6 sec.	2.3 sec.

- d. Door dwell time for hall calls: 4.0 sec with Advance lantern signals
- e. Door dwell time for hall calls: 5.0 sec without Advance lantern signals
- f. Door dwell time for car calls: 3.0 seconds
- g. Reduced non-interference dwell time: 1.0 second

2. Maintain the following ride quality requirements for the passenger elevators:

a. Noise levels inside the car shall not exceed the following:

- 1) Car at rest with doors closed and fan off - 40 dba.
- 2) Car at rest with doors closed, fan running - 55 dba.
- 3) Car running at high speed, fan off - 50 dba.
- 4) Door in operation - 60 dba.
- 5) Sound isolation: Noise level relating to elevator equipment operation in the machine room shall not exceed 80 dBA. All dBA reading shall be taken three (3) feet off the floor and three (3) feet from equipment.
- 6) Airborne Noise: Measured noise level of the elevator equipment during operation shall not exceed 50 dBA in elevator lobbies and 60 dBA inside the car under any conditions including door operation and car ventilation exhaust blower on its highest speed.

b. The controlled rate of change of acceleration and retardation of the car shall not exceed 0.1G per ft/s/s and the maximum acceleration and retardation shall not exceed 0.2G per ft/s/s.

c. Starting, stopping, and leveling shall be smooth and comfortable without appreciable steps of acceleration and deceleration.

- 1) The accelerometer used for this testing shall be capable of measuring and recording acceleration to nearest 0.01 m/s<sup>2</sup> (1 milli-g) in the range of 0-2 m/s<sup>2</sup> over a frequency range from 0-80 Hz with ISO 8041 filter weights applied. Accelerometer should

provide contact with the floor similar to foot pressure, 60 kPA (8.7psi).

B. Pre-Test and Acceptance Testing

1. Comply with the requirements of Division 01.
2. The Contractor shall provide at least five (5) days prior written notice to the Government and Consultant regarding the exact date on which work specified in the Contract Documents will reach completion on any single unit of vertical transportation equipment.
3. Pre-test the elevators and related equipment in the presence of the Resident Engineer or his authorized representative for proper operation before requesting final inspection. Conduct final inspection at other than normal working hours, if required by Resident Engineer.
4. Procedure outlined in the Inspectors Manual for Hydraulic Elevators, ASME A17.2 shall apply.
  - a. Final test shall be conducted in the presence of and witnessed by a third party ASME QEI-1 Certified Elevator Inspector, contracted by the VA.
  - b. Government shall furnish electric power including necessary current for starting, testing, and operating machinery of each elevator.
5. Contractor shall furnish the following test instruments and materials on-site and at the designated time of inspection: properly marked test weights, oil pressure gauge, voltmeter, amp probe, thermometers, direct reading tachometer, megohm meter, vibration meter, sound meter, light meter, stop watch, and a means of two-way communication.
6. Inspection of workmanship, equipment furnished, and installation for compliance with specification.
7. Full-Load Run Test: Elevators shall be tested for a period of one hour continuous run with full contract load in the car. The test run shall consist of the elevator stopping at every floor, in either direction of travel, for not less than five or more than ten seconds per floor.
8. Speed Test: The actual speed of the elevator shall be determined in both directions of travel with full contract load and no load in the elevator. Speed shall be determined by certified tachometer. The actual measured speed of the elevator with all loads in either direction shall be within five (5) percent of specified rated speed. Full speed runs shall be quiet and free from vibration and sway.



9. Temperature Rise Test: The temperature rise of the pump motor shall be determined during the full load test run. Temperatures shall be measured by the use of thermometers. Under these conditions, the temperature rise of the equipment shall not exceed 50 degrees Centigrade above ambient temperature. Test shall start when all machine room equipment is within 5 degrees Centigrade of the ambient temperature. Other tests for heat runs on motors shall be performed as prescribed by the Institute of Electrical and Electronic Engineers.
10. Car Leveling Test: Elevator car leveling devices shall be tested for accuracy of leveling at all floors with no load in car and with contract load in car in both directions of travel. Accuracy of floor level shall be within plus or minus 3 mm (.125 in.) of level with landing floor for which the stop has been initiated regardless of load in car or direction of travel. The car leveling device shall automatically correct over travel as well as under travel and shall maintain the car floor within plus or minus 3 mm (.125 in.) of level with the landing floor regardless of change in load.
11. Insulation Resistance Test: The elevator's complete wiring system shall be free from short circuits and ground faults and the insulation resistance of the system shall be determined by use of megohm meter, at the discretion of the Elevator Inspector conducting the test.
12. Overload Devices: Test all overload current protection devices in the system at final inspection.
13. Limit Stops:
  - a. The position of the car when stopped by each of the normal limit switches with no load and with contract load in the car shall be accurately measured.
  - b. Final position of the elevator relative to the terminal landings shall be determined when the elevator has been stopped by the final limits. The lower limit stop shall be made with contract load in the elevator. Elevator shall be operated at inspection speed for both tests. Normal limit stopping devices shall be inoperative for the tests.
14. Working Pressure: Verify working pressure of the hydraulic system by pressure gauge placed in the system line. Take readings with no load and full load in car.
15. Test automatic shut-off valve for proper operation.
16. Operating and Signal System: The elevator shall be operated by the operating devices provided and the operation signals and automatic floor leveling shall function in accordance with requirements specified. Starting, stopping and

leveling shall be smooth and comfortable without appreciable steps of acceleration or deceleration.

17. Performance of the Elevator supervisory system shall be witnessed and approved by the elevator inspector and a representative of the Resident Engineer.
18. Evidence of malfunction in any tested system or parts of equipment that occurs during the testing shall be corrected, repaired, or replaced at no additional cost to the Government, and the test repeated. If equipment fails test requirements and a re-inspection is required, the Contractor shall be responsible for the cost of re-inspection; salaries, transportation expenses, and per-diem expenses incurred by the elevator inspector and the representative of the Resident Engineer.

END OF SPECIFICATION

**14-99-00**  
**Elevator Maintenance**  
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## 1.0 STATEMENT OF WORK:

- A. Provide monthly maintenance, semi-annual inspection and annual safety testing and five year load test for all elevators awarded for construction under this Contract. Performance period will begin with: NTP (Notice to Proceed) Date of Project 657-15-200, until completion of Construction contract and Warranty period.
- B. The Contractor shall provide full elevator maintenance service, in compliance with the **ANSI/ASME Safety Code** requirements, the manufacturer's recommendations, the **Elevator Industry Field Employees' Safety Handbook**, **National Electrical Code**, and all other applicable laws, regulations, rules, ordinances, codes, etc. Full maintenance service is defined as all services, repairs and testing necessary to maintain all elevators, appurtenances and accessories in a fully operational mode at all times except for prescheduled downtime including all labor, parts and materials.
- C. Measurements of elevator speed, door opening and closing times, performance time, door closing force, floor to floor performance times, and mean times between service calls, ride quality, stopping accuracy, downtime, and review of preventive maintenance and inspection reports shall be the governing factors in determining the adequacy of the elevator maintenance. Any deviations shall be justified to and approved by the COR. No deviations to the performance measures can be made until the contract is modified by the Contracting Officer.
- D. The Contractor shall be responsible for all costs associated with accomplishing repairs and or replacements, including labor, equipment, and supplies for all equipment and systems specified or recommended by the installing contractor or system manufacturer. The Contractor shall furnish all labor and supplies, parts and materials necessary to regularly and systematically clean, examine, adjust, lubricate as required and if conditions warrant, repair or replace, as necessary for full operations.

## 2.0 CONTRACT EXPECTATIONS AND EXCLUSIONS:

### A. All maintenance items shall include:

- 1. Machine, worm, gear, thrust bearings, drive sheave, drive sheave shaft bearings, brake pulley, brake coil, brake contact, brake linings and component parts.
- 2. Machine motor, motor generator, motor windings, rotating element, commutator, brushes, brush holders and bearings.
- 3. Controller, selector and dispatching equipment, all relays, solid state components, resistors, condensers, transformers, contacts, leads, dashpots, time devices, computer devices, CRT devices, selector tape or wire and mechanical and electrical driving equipment.
- 4. Governor, governor ropes, governor sheave and shaft assembly, bearings, contacts, and governor jaws.
- 5. Deflector or secondary sheave, bearings, car and counterweight

- buffers, car and counterweight guide rails, top and bottom limit switches, governor tension sheave assembly, compensating sheave assembly, counterweight guide shoes including rollers or gibs.
6. Hoist way door interlocks, hoistway door hangers, bottom door guides and auxiliary door closing devices.
  7. Automatic power operated door operator, car door hanger, car door contact, door protective devices, load weighing equipment, car frame, car safety mechanism, platform, wood platform flooring, car guide shoes including gibs and rollers.
  8. Car operating panel(s) and equipment, hall lanterns, hall buttons and signal devices.
  9. Cab Lighting
  10. Where applicable to hydraulic elevators include cylinder head, plunger exposed surfaces, plunger gland and packing, pumps, exposed piping, fittings and flexible pipe connections, operating controls, check and relief valves, valves, gages and tanks.
  11. All parts and materials shall be of the original manufacturer's design and specification, or equal thereto. All lubricants shall be as recommended by the manufacturer.

**B. Work excluded:**

The following work is specifically excluded from this contract:

- a. Repair or replacement made necessary due to negligence or misuse of the equipment by persons other than the Contractor, his representatives or his employees. The COR or designee must approve in advance any extra charge work attributed to vandalism or misuse. No invoice will be paid without prior approval. Any repairs due to misuse or negligence shall be billed separately according to the negotiated price with the contractor at the time of the incident.
- b. Replacement of underground hydraulic piping or hydraulic cylinder.
- c. For the purpose of clarification, any item not specifically excluded shall be considered the Contractor's responsibility.
- d. All travel costs associated with the performance of this contract are the responsibility of the contractor and are provided at no additional cost to the Government as part of this contract. Travel costs are defined as but are not limited to time and vehicle costs for personnel in travel to and from job site for all duties outlined in this specification, normal shipping charges on any parts or materials covered by this contract, costs associated with the normal shipping of parts or equipment out for repair that are covered under this contract, etc.
- e. The Contractor shall be fully responsible and accountable for the operation of all equipment beginning on the date specified in the Notice to Proceed.
- f. These specifications are a statement of the minimum level of work and services that are to be provided in certain areas under this contract. They are not intended to be, nor shall they be construed as, limiting specifications or requirements. At a minimum, the contractor will be required to take all steps and

measures which would be taken by a prudent building owner to maximize the life expectancy of the existing elevators and related systems and ensure safe and reliable elevator operation.

### 3.0 SCHEDULED MAINTENANCE AND PM

- A. The Contractor shall develop and implement a Performance Requirement Summary of preventive maintenance (PM) schedule acceptable to the COR. All equipment shall be maintained in accordance with the manufacturer's recommendations, the best practices of the industry, and applicable codes, standards, and regulations. **If a conflict arises between these standards, the most stringent will prevail. The contractor shall provide on-site elevator maintenance at a minimum of 1-hour per week for traction units, 1-hour every two weeks for hydraulic units and 1-hour per month for Dumbwaiter units.** The weekly schedule shall be coordinated with the COR. A copy of the PM program will be provided to the COR for review and acceptance during the solicitation phase for approval. The PM program must be acceptable to the COR prior to the commencement of the contract period.
- B. All maintenance work that requires an elevator to be taken out of service shall be coordinated with the COR and the contractor shall report to the COR the status of elevator equipment or systems not operating by the close of each workday. Any equipment or system not operational by the official start time of the occupants shall be reported to the COR by 7:00 a.m. that day. The contractor is responsible for the installation of signs and/or barricades as related to equipment and/or systems as deemed necessary by the COR. In the event an elevator is shutdown, an "Out of Service" sign must be placed at each call button on all floors.
- C. The Contractor shall not change or alter the existing elevator PM schedule or any maintenance program without written authorization from the COR. If changes are authorized, the Contractor shall make appropriate revisions to the elevator drawings and/or specifications. All parts or components installed, or improvements made, by the Contractor during the term of this maintenance contract shall become and remain the property of the Government.
- D. The Government reserves the right to require the Contractor to make such tests as and when deemed advisable to ascertain that the requirements of this contract are being fulfilled. All tests shall be scheduled through the COR and the Government reserves the right to witness all testing.
- E. In order to provide for uninterrupted Government business and elevator service for the handicapped, unnecessary out-of-service periods for elevators cannot be tolerated. Therefore, it is essential that elevator repairs be affected immediately.
- F. The Contractor shall maintain the machinery spaces, elevator pits, car tops, storage areas, etc. in a clean and orderly manner. When work is performed in these areas, the Contractor's Personnel shall clean up all debris and leave the area in a presentable condition. The machinery room floors and the equipment located within the machinery rooms shall be painted as necessary to repair damage done by the contractor to maintain the appearance of the room and equipment. When painting, the Contractor must comply with the **ANSI color coding system outlined in the ANSI A13.1, Scheme for the Identification of Piping Systems**, and maintain the identity (identification information) of the equipment. The Contractor must obtain the approval of the COR before storing anything in machinery spaces. Operating supplies such as lubricants, rags, cleaners, etc., shall be properly secured in

containers approved by the COR. Storage shall not negatively impact the means of egress, fire protection systems, and emergency lighting; nor, shall it significantly increase the amount of combustible material in the machinery space. Clearances from electrical equipment shall be maintained as required by **NFPA 70, the National Electrical Code**

#### **4.0 REPORT OF SERVICES and LOG:**

- A.** Upon arrival: Upon Arriving on station to perform maintenance duties, the Contractor's Serviceman will report to the Engineering Office to sign-in (only during normal working hour 7:00AM to 5:30PM) before going to the work site. Upon completion of any inspection or service, including any call back work, the contractor or his representatives shall make a brief verbal report of what was accomplished before departure (only during normal working hours 7:00AM to 5:30PM) from the Medical Center premises. Such reports shall advise of any repairs or repair parts required that are necessary to maintain the equipment in perfect running condition. This report shall be made in person to the Engineering Officer to be designee on duty at the time. A brief written report shall be submitted to the COR prior to the 25day of each month, certifying compliance with inspection and service requirements of the previous month and noting any exceptions and reasons for the exceptions. Negative reports are required to insure that this contract requirement is met. Additionally, the Contractor shall make a written report to the Contracting Officer and to the COR of the VA Medical Center within five (5) working days from the time the Contractor encounters a need for repairs or repair parts, which, in the Contractor's opinion, are required to maintain the equipment in perfect operating condition.
- B. SPECIAL REQUIREMENTS VAMC, VAMC JOHN COCHRAN DIVISION ST. LOUIS, MO:**  
The maintenance Contractor will report to the COR when onsite during normal and for sign-in before going to the work site.

#### **4.1 LOG BOOK:**

- A.** The Contractor shall supply and maintain a current maintenance log book for each elevator documenting the Management Information Data. The log book shall remain in the equipment room for each elevator, or in a location designated by the COR at each medical center. The log book shall be annotated as service is rendered describing in detail problems and corrective action taken. A record of all call-backs and resulting repair shall be kept by the contractor and annotated in the maintenance log book indicating all services rendered, any difficult experiences and corrective measures that may improve service. All scheduled inspections and emergency call back service shall also include (1) Person (2) Date (3) Purpose (4) Problems/Difficult Experiences (5) Corrective Measures Taken and (6) Time started and time completed or stopped.
- B.** Each month the Contractor shall subject all elevators provided with firefighters' emergency operation to Phase I (maintenance and fire service personnel system verification checks) recall by use of the key switch, and a minimum of one-floor operation on Phase II.
- C.** The Contractor shall correct all deficiencies. The Contractor shall maintain a record of findings and all details shall be annotated in the maintenance log book located in each elevator machine room and make it available to the COR and elevator inspection personnel.

#### **5.0 PERSONNEL**

- A.** The contractor shall have in its employ at all times a sufficient

number of capable and qualified employees to enable it to properly, adequately, and safely manage, operate, maintain and account for the elevator system.

- B. The contract maintenance manager responsible for the management and scheduling of work to be performed under this provision, shall possess at least 5 years of recent (within the past 7 years) experience in managing personnel responsible for the operation and maintenance of elevator equipment of the approximate size, supervisory control systems and other characteristics of the elevators to be operated and maintained under this contract. A detailed resume containing the information specified herein must be submitted to the CO or his/her designee for approval prior to assignment of the contract manager to the contract. Both new and replacement contract managers must meet these qualification standards. The full name of the proposed contract manager.
- C. The name(s) and address (es) of the companies for whom the proposed manager worked for the past 7 years along with the name(s) and telephone number(s) of his or her immediate supervisor
- D. These certification documents shall be submitted with the proposal documents before award.

#### **5.1 QUALIFICATIONS OF THE SUPERVISOR**

- A. The contract maintenance supervisor shall be responsible for the direction of work to be performed under this provision, shall possess at least 5 years of recent (within the past 7 years) experience in supervising personnel responsible for the operation and maintenance of elevator equipment of the approximate size, supervisory control systems and other characteristics of the elevators to be operated and maintained under this contract. A detailed resume containing the information specified herein must be submitted to the CO or his/her designee for approval prior to assignment of the contract manager to the contract. Both new and replacement supervisors must meet these qualifications:
- B. The Full Name of the Supervisor.
- C. The name(s) and address (es) of the companies for whom the proposed supervisor worked for the past 5 years along with the name(s) and telephone number(s) of his or her immediate supervisor(s).

#### **5.2 QUALIFICATIONS OF JOURNEYMAN ELEVATOR MECHANICS**

- A. The full name of the proposed mechanic.
- B. A detailed description of the employment history of the proposed mechanic.
- C. Journeyman status as recognized by the industry and be licensed by the state, local authority, and/or the city local authority in those trades, crafts or professions which require licensing by such jurisdictions. The license must be of a grade or other level consistent with the requirement of the work being performed and/or as established by the referenced jurisdictions.



- D. All candidates for approval prior to the assignment of any mechanic to the contract shall be approved by the COR. Both new and replacement mechanics must meet qualification standards.
- E. Elevator Mechanic Helpers may perform work and/or repairs for which they are qualified.
- F. Elevator Mechanic Helper qualifications are determined by state, local and/or city requirements.

In the absence of any licensing requirement by state and local jurisdictions, the contractor shall certify, in writing, to the COR, that the elevator personnel involved in the performance of this contract are competent. The certification documents shall be presented as submittals after award.

#### **6.0 ITEMS TO BE SUPPLIED BY THE MAINTENANCE CONTRACTOR:**

- A. Parts installed on the elevators covered by this specification, shall be new and genuine parts supplied by the original equipment manufacturer, or its successor prior to the installation of the part. The Contractor shall maintain a stock of applicable replacement parts to reduce to a minimum the interruption of elevator service. When replacing existing parts or installing new parts, the Contractor shall install energy efficient parts to the maximum extent possible.
- B. The Contractor shall provide a number that is available on a 24 hour a day, 7 days a week basis for emergency calls.
- C. The Contractor shall provide approved metal waste containers for flammable and combustible waste associated with the performance of this contract. Flammable and combustible waste shall be removed from the premises daily. The Contractor shall provide approved metal storage cabinets for flammable materials associated with the performance of this contract. Storage of flammable and combustibles liquids shall be limited as much as possible and shall conform to the latest edition of NFPA 30, Flammable and Combustible Liquids Code.

#### **7.0 INSPECTIONS:**

- A. Elevator safety inspections:  
Elevators requiring monthly maintenance, semi-annual inspection and annual safety testing and five year load test:

### Group/Elevator #/Type-Drive

1. THE ELEVATOR GROUPS ARE AS FOLLOWS:
  - a. Group A1/Bank A, Elevators: 1, 2, 3, & 4 /Passenger-Traction MCE
  - b. Group A2/Bank A, Elevators: 5 & 6/Service-Traction MCE
  - c. Group B/Bank B, Elevators: 7, 8, & 9 /Passenger-Traction MCE
  - d. Group C/Building 1 Elevator Car 10/Passenger-Hydraulic
  - e. Group D/Building 1 Clean and Soiled Cart Lifts/Automatic Montgomery
  - f. Building 1 Pharmacy Dumbwaiter/Automatic Matot.
- B. The contractor shall be responsible for having the following inspections accomplished by an **Independent VA Contract Inspector** in accordance with the requirements of the latest edition of ansi/asmi qei-1, standard for the qualification of elevator inspectors. The contractor shall provide personnel who are familiar with the equipment to perform tests and assist the inspector.
- C. The contractor shall schedule and have performed the periodic inspections and tests of all elevators at the recommended intervals found in the effective edition of ansi/asme a17. The maintenance contractor must coordinate for the performance of the safety inspections with the **Independent VA Contract Inspector's** organization.
- D. The contractor shall furnish a copy of the inspection schedule to the COR. (This list shall be estimated for proposal submission and finalized before award of the contract. This schedule shall clearly indicate the edition of **ansi/asme a17**. The COR will be advised of any changes to the schedule and notified 5 working days in advance of the inspection date to afford the COR an opportunity to observe the inspection. The required semiannual inspection of the emergency signaling device (alarm) and the means of two-way conversation will be recorded on an approved form. Copies of this form will be provided to the contractor by the COR.
- E. The contractor shall provide a qualified employee to accompany the inspector during the inspection.

#### 7.1 INDEPENDENT VA CONTRACT INSPECTOR:

- A. The Independent VA Contract Inspector shall furnish a written report of each inspection to the COR and to the maintenance contractor. The report shall be submitted on the following checklists from the **American Society of Mechanical Engineers (ASME): Checklist for Inspection of Electric Elevators, Checklist for Inspection of Hydraulic Elevators**, as appropriate. The maintenance contractor shall be responsible for the correction of all listed deficiencies within the scope of the contract by the date specified by the COR. Any deficiencies marked "emergency" must be corrected immediately. When all listed deficiencies have been

corrected the contractor shall sign and date the inspection report and return it to the COR.

- B. The contractor shall be responsible for obtaining the signed form from the Independent VA Contract elevator inspector. Copies of form will be provided to the COR.

## 7.2 ADJUSTMENTS AND TESTS

- A. The contractor is responsible for the accomplishment of all tests required, at the intervals specified and in accordance with, the American National Standard Safety Code for Elevators and Escalators manual. Most current publication will be used at all times. Copies of all test results will be furnished to the COR.
- B. The contractor shall maintain the elevators as stated in, **Performance Standards**.
- C. The fire alarm capturing device must be maintained and tested. This testing shall be conducted once each month of each contract year. Such tests shall not interfere with the normal operation of the building.
- D. The contractor shall check the Group Automatic Operation system annually and make necessary tests to ensure that all circuits and time settings are properly adjusted and that the system performs as designed and installed by the manufacturer.
- E. Except for group supervisory control system tests or other tests on elevators and when deemed advisable to ascertain that the requirements of this contract are being fulfilled. All tests shall be scheduled through the COR and the Government reserves the right to witness all testing.

## 7.3 TESTING SCHEDULE (ALL ELEVATORS)

### A. Safety Tests:

- a. The safety tests, as required by **ANSI/ASME A17**, shall be performed by the Contractor employees and Witnessed by the VA Contract Inspector.

### B. Safety Inspection Schedule:

- a. The tests, as required by ANSI/ASME A17, shall be performed and witnessed by the VA Contract inspector. Maintenance contractor will coordinate with testing contractor and medical center(s) on times and dates of the testing of each test.
- b. When deemed advisable to ascertain that the requirements of this contract are being fulfilled. All tests shall be scheduled through the COR and the Government reserves the right to witness all testing.
- c. The Government reserves the right to require the contractor to make such tests as deemed necessary within the limits of the American National Standard Safety Code for Elevators and Escalators. Measurements of elevator speed, door opening and closing times, performance time, door closing force, floor to floor performance times, mean times between service calls, ride quality, stopping accuracy, downtime, and review of preventive maintenance and inspection reports shall be the governing factors in

determining the adequacy of the elevator Testing.

- d. Contractor may inspect all elevators within first 15 days of award of contract to ensure elevators are in proper working order and up to safety code and notify COR of any deficiencies.
- e. The Maintenance Performance Schedule shall be submitted when the proposal documents before award (See Performance Requirements Summary). The Contractor shall submit to the COR a work schedule for the maintenance of the elevators at each Location.

## **8.0 SUPPLIES, MATERIALS, AND EQUIPMENT**

### **A. The Contractor shall:**

- a. Furnish the labor, supplies, materials, equipment (including vehicles) and employee training necessary for the performance of the work specified in the contract, unless otherwise specified herein

### **A. GOVERNMENT FURNISHED PROPERTY:**

- b. In accordance with the provisions for Government Furnished Property, the Government will furnish utilities to perform the requirement of this contract.

## **9.0 QUALITY CONTROL:**

### **A. The Contractor:**

- a. The contractor shall maintain a complete Quality Control (QC) Plan and administer a QC Program in accordance with its final QC plan after award of the contract. Contractor must ensure that the requirements of the contract are met, including the minimum performance requirements, as specified in the resultant PWS. The final Quality Control Plan shall address the following, at a minimum:
  - 1. A method of identifying deficiencies in the quality of services performed and
  - 2. List of corrective action or measures used to prevent deficient or unsatisfactory performance.
- b. An inspection system covering all required performance tasks;
  - 1. A method of identifying deficiencies in the quality of services performed and
  - 2. List of corrective action or measures used to prevent deficient or unsatisfactory performance.
- c. Contractors system for maintaining a record of all inspection reports and proposal for having them available or sending to the Government.
- d. Strike prevention plan and Contractor emergency plan.
- e. Contractors work schedule and the approach to provide performance based elevator maintenance and repair services at the medical center due to the high visibility and daily usage by staff and public.
- f. Contractor must notify the Contracting Officer (CO) and Contracting Officers Representative (COR), in writing, of any proposed changes to the QC Program, and Plan. The final QC Plan shall be submitted in accordance with contract requirements. No change to the final QC Plan shall be implemented prior to the mutual agreement of parties.

## 9.1 Supervision:

- A. The Contractor shall ensure that work required under any resultant contract is monitored by providing supervision (Supervisor/Alternate) to comply with the terms and conditions contained herein. The Supervisor/Alternate shall be the Contractor's primary representative on-site, having full authority to act on matters pertaining to performance of services required. The Supervisor/Alternate shall be available while the contract work is in progress (including emergencies and at any time specified for after hour services.) The Supervisor/Alternate will receive notices, reports, request or other communications from either the CO or COR.
- B. The Contractor shall designate the On-Site Supervisor and Alternate in Contract Administration Section. The Alternate will have the same responsibilities and authorities as the supervisor in his/her absence.
- C. The Contractor shall register all employees with the COR upon commencement of the contract. The Government will coordinate site access with contractor after award.
- D. The Contractor shall immediately report to the COR, in writing, any termination of site Contractor personnel and the cause of such termination.
- E. The Contractor shall report all damage to Government property, personal injuries, and/or hazardous conditions to the COR or designee immediately, after such occurrence.

## 10.0 Service Calls/ Call Backs:

- A. Contractor shall respond to requests made by the COR/Alternate, or authorized designee, within one hour by telephone, within two hours to be on site, during normal working hours. The Government is not anticipated to make service call requests during other than normal working hours. The course of action to resolve a service call problem and to determine if overtime will be allowed will be determined after consultation between the CO/COR and the Contractor.
- B. Contractor shall respond to emergency requests or callbacks made from the CO, COR by contacting the appropriate party within 30 minutes by phone. This is required 24 hours a day 7 days a week. The Government representative will identify these calls as emergencies and will coordinate with the Contractor resolution of the problem and if overtime shall be required complete repairs. From the time the appropriate party has been contacted, the contractor shall be on site within two hours to correct or repair the elevator. Trapped personnel calls require the contractor to be on site within one hour of notification.

## 11.0 DELIVERABLES AND TIMELINE/SCHEDULE

- A. All reports by the contractor to the Government under this contract shall include the following information:

- a. Contract number and title;
- b. Type of report and period of performance being reported;

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- c. Authors;
- d. Name and address of contractor;
- e. Date of report.
- f. The contractor shall submit all paper-copy reports (PR) on 8-1/2" x 11" paper

At a minimum, the Government requires a monthly service report. The Contractor shall ensure that all reports, as specified in this section, are submitted to the Government on time. The report shall be submitted on or about the 25th day of each month.

#### **12.0 PERIOD OF PERFORMANCE**

- A. The period of performance of this contract will be for the duration of the aforementioned construction contractor

#### **13.0 GENERAL DEDUCTIONS**

- B. It is the objective of the Government to obtain complete and satisfactory performance in accordance with the terms of the specifications and requirements in this contract. To this end, the Government is requesting the complete performance of each task identified in the specification. Deductions for work performed improperly may be made as though the work has not been performed.

#### **13.1 CALCULATION OF DEDUCTIONS**

- C. The deduction criteria in this Section will be used by the Government in determining monetary deductions for nonperformance of work under this contract or for deficiencies in the work performed, and supplements the "Default" clause contained in the contract, but does not reduce or limit the Government's right there under.

#### **13.2 DETERMINATION OF DEDUCTION AMOUNTS**

- A. Inadequate performance is just as undesirable as nonperformance, and the cost of correcting inadequate performance may equal or exceed the cost of initial performance.
- B. Withholding Monies for Non-submission of Report:
  - a. If the contractor fails to prepare and/or submit acceptable reports as called for within the required time frame, this may be construed to mean that the contract work has not been performed and the Government will withhold payments until the required reports are satisfactorily completed and/or submitted to the COR. The report shall be submitted on or about the 25th day of each month.
- C. Withholding Monies for Failure to Maintain and/or Provide Parts
  - a. If the Contractor fails to provide the maintenance services specified in this solicitation, and restore service within 24

hours of establishment of the need for such parts, the contract will be reduced by \$200 per day, per elevator until elevator(s) are restored to service and accepted by the VA.

#### 14.0 REMOVAL OF ELEVATOR(S) FROM SERVICE

- A. When the Government removes one or more elevators named in this contract from service in order to perform work on such elevators that is outside the scope of this contract, the monthly payments due the Contractor may be reduced. The Contractor shall be notified, in writing, by letter or contract modification, at least 3 full work days in advance of the elevator(s) being removed from, or returned to, service. If the elevator(s) is to be removed from service for 30 consecutive calendar days or less, the CO will negotiate an equitable adjustment with the Contractor and make the necessary adjustments on the monthly invoice when authorizing payment. If the elevator(s) is to be removed from service for more than 30 consecutive calendar days, the CO will issue a modification to the contract and negotiate an equitable adjustment in the contract price in accordance with the Changes clause. The period for reducing payments will begin on the effective date specified in the notice and will continue through the day before the elevator(s) is returned to service.

#### 15.0 PERFORMANCE REQUIREMENTS SUMMARY (PRS)

- A. The contractor agrees to maintain, at all times, the minimum performance requirements for the Vertical Transportation System (VTS). The maintenance performance measurements include, but are not limited to the following:
- B. The hours below represent maintenance only, "not call backs".
1. Traction Elevator Maintenance: One (1) hour per week
  2. Hydraulic Elevator Maintenance: One (1) hour every two weeks
  3. Cart lifts Elevator Maintenance: One (1) hour every two weeks
  4. Dumbwaiter Elevator Maintenance: One (1) hour per month

#### 16.0 MILESTONE CHART FOR CONTRACTOR DELIVERABLES

<u>ITEM</u>	<u>DUE DATE</u>
PM Submittal	Provide as submittal
Systems not operational by the official start time of the occupants	7:00 a.m. that day
Operating Test	Monthly
Subcontracts if applicable	Provide as submittal
Resume for Contract Manager and Supervisor	Provide as submittal

Employee Resumes	Provide as submittal
Resumes for Replacement Employees	Provide as submittal
License for Elevator Mechanic or certification of competency	Provide as submittal
Metal waste containers	Start of contract
Accounting of Government Property	Upon request and termination Contract.
Copy Inspection Schedule	Provide as submittal
Management Information Data	25th of each month
Written Report of Inspection	25th of each month
Copy of all tests required	25th of each month
Service call log/record	25th of each month
Check charts and logs each piece of equipment	25th of each month



Monthly progress report	25th of each month
Notification of Inspection	25th of each month
Notification of Completion of Existing Deficiency Repairs	25th of each month
Quality Control Plan	Provide as submittal
Quality Control Inspection Reports	Submit Daily
Strike Contingency Plan	Provide as submittal
Contractor Emergency Plan	Provide as submittal
Interim Evaluations under CPAR	Annually to coincide with anniversary date of contract
Contractor Emergency Plan Interim Evaluations under CPS	Provide as submittal

#### 17.0 DEFINITIONS:

##### **A. Acts of God:**

- a. An act, event, happening or occurrence due to natural causes and inevitable accident, or disaster and is in no sense attributable to human acts.

##### **B. Contract Discrepancy Report:**

- a. Any report prepared by the Government's representatives of deficient or defective service

##### **C. Contracting Officer (CO):**

- a. The CO has the overall responsibility for administering this contract. He/she alone, without delegation, is authorized to take actions on behalf of the Government to amend, modify, or deviate from the contract terms, conditions, requirements, specifications, details and delivery schedules; make final decisions on disputed deductions from contract payments for nonperformance or unsatisfactory performance; terminate the contract for convenience or default; and issue final decisions regarding contract questions or matters under dispute.

##### **D. Contracting Officer's Representative (COR):**

- a. The COR is designated by the CO at time of award and if necessary revised by letter during the contract period to assist him/her in discharging his/her responsibilities. The responsibilities of the COR include, but are not limited to: Evaluating Contractor performance with the Government's representative at the work site; advising the Contractor of proposed deductions for nonperformance or unsatisfactory performance; compliance with contract requirements insofar as the work is concerned; and advising the CO of any factors which may cause delay in work performance.

##### **E. Contractor:**

- a. The term Contractor refers to the individual, firm, partnership, company, or corporation providing the services and directly contracting with the Veterans Affairs Administration as the prime contractor in the performance of the work described herein.

##### **F. Defective Service:**

- a. A unit of service that does not conform with specified requirements.

##### **G. Elevator:**

- a. The term elevator is used to mean all elevator, escalator, dumbwaiter, handicapped lift and wall glider equipment, if applicable, at the location(s).

**H. Emergency Call-Back:**

- a. Emergency call-back service calls consist of promptly responding to requests for emergency service 24 hours per day, 7 days per week. The contractor shall report to the site of the emergency within Two Hours of the time of notification of appropriate party and shall remain on the job until the emergency has been resolved. If the situation cannot be resolved immediately, the Contractor shall promptly notify the COR of the time and date corrective action will be taken. Requests for service may be made by the COR by telephone or other means. Emergency service consists of freeing individuals trapped in a stalled car (within one hour), restoring inoperative elevators which are causing disruption to the arrival and departure of building occupants, or other situations determined by the COR to be an emergency nature.

**I. Government Contract Inspectors:**

- a. Government Contract Inspectors are responsible for inspecting and monitoring the Contractor's day- to-day work. The responsibilities of the Contract Inspector include, but are not limited to: Inspecting the Contractor's work to ensure compliance with the contract requirements; documenting, through written inspection reports, the results of all inspections conducted; ascertaining that all defects or omissions are corrected; conferring with Contractor representatives regarding any problems encountered in work performance, and generally assisting the COR in meeting his/her contract responsibilities. The Contractor shall make every attempt to join the inspector while he/she conducts inspections under this contract.

**J. Installing Contractor:**

- a. Construction contractor or subcontractor who originally installed the equipment, system, part, item, unit, or component.

**K. Management Information Data:**

- a. Reports, records, and logs that contain information relative to the operation of the building's elevators such as but not limited to: service call logs and sign-in and sign-out sheets. This information must be maintained in an automated data system that is agency compatible.

**L. Negligence:**

- a. Is the failure to use care under the circumstances, it is the doing of some act which a person of ordinary prudence would not have done under similar circumstances or failure to do what a person of ordinary prudence would have done under similar circumstances.

**M. Overtime Services:**

- a. Overtime services are defined as work within the scope of the contract originally intended to be performed during normal working hours, where the Government requests the work be

performed outside of normal working hours to expedite the return of an elevator to operating condition or to minimize disruption to tenants.

**N. Normal Working Hours:**

- a. 7:00 AM through 5:30 PM, Monday through Friday,

**O. Other than Normal Working/Duty Hours:**

- a. Work performed outside the hours of **7:00 AM through 5:30 PM, Monday through Friday**, excluding Federal holidays.

**P. Performance Requirements Summary (PRS):**

- a. Identifies the key service outputs of the contract that will be evaluated by the Government to assure contract performance standards are met by the Contractor.

**Q. Performance Work Statement (PWS):**

- a. The Performance Work Statement details the work requirement and can be referred to as the specification.

**R. Quality Assurance:**

- a. Actions taken by the Government to ensure services meet contract requirements.

**S. Quality Control:**

- a. Those continuous actions taken by a Contractor to control the performance of his or her employees and subcontractor's services so that they consistently meet the contract requirements.

**T. Quality Performance Standard:**

- a. The overall quality performance standard the contractor will be held to is: "The Contractor will perform elevator maintenance service at the facility throughout the contract period, with the outcome of ensuring that the physical and capital assets are maintained and preserved in the same or better condition that they were in when the Contractor first started the contract, normal operating wear taken into account."

**U. Service Calls:**

- a. Service calls are responses and subsequent repairs or adjustments of elevator equipment and systems or problems reported to the Contractor by building occupants or VA personnel. The Contractor shall respond promptly to requests for on-site service. If the service call cannot be resolved the Contractor shall immediately secure the elevator and notify the COR of the problem and the time and date corrective action will be completed (excluding priority elevators such as surgical. In the case of priority elevators, work shall continue with immediate notification to the COR of the problem and time and date corrective action will be completed.

**V. Shall vs Must:**

- a. Throughout this solicitation, the terms "shall" and "must" are used. "Shall" and "must" denote the imperative. They indicate an obligation to act. In this solicitation, and any resulting contract, "shall" and "must" have the same meaning.

**W. Sign In/Sign Out Log:**

- a. Designated log format used for Contractor/Subcontractor employee's identification by providing appropriate information and employee signatures as to when they enter and exit the building.

**X. Supervisors:**

- a. The term "on-site supervisor" means a person designated in writing by the contractor who has authority to act for the contractor on a day-to-day basis at the work site.

**Y. Vandalism:**

- a. Willful and malicious destruction of property.

**Z.**

**Warranted as Presented:**

- a. The presenter guarantees the report or item presented as being accurate and truthful.

**18.0 APPLICABLE PUBLICATIONS**

**1. General:**

Publications applicable to this Performance Work Statement (PWS) are listed below. The Contractor shall be guided by and is recommended to follow these publications to the extent that he/she performs specific and general work related tasks which are governed by these publications.

Changes: It is the responsibility of the Contractor to act on any supplements or modifications to the listed publications during the life of this contract, when they are provided by the COR and action is requested in writing. Prior to implementing any action to a revision, supplement, or modification that will result in an increase or decrease in contract price, the Contractor shall submit to the CO a price proposal for such change and obtain written direction when and if he/she is to implement the new requirements. The new requirements will become a contract modification when they are agreed upon in writing by the Contractor and the Government.

**2. Publications:**

The publications are the recommended regulations, standards, and codes for job accomplishment.

However, they are not absolute and other approaches will be considered. When deviations from this list are proposed, the offerors are required to explain their rationale for such deviation to the COR immediately.

<u>PUBLICATION PORTION</u>	<u>TITLE</u>	<u>DATE</u>
29 CFR Part 1900 PBS P 5850.1B	OSHA General Industry Standards Buildings Maintenance Management Handbook	CURRENT ALL Rev ALL April 1992
40 CFR	Clean Air Act	July 1992 ALL
ANSI/ASME A17	American Society of Mechanical Engineers Safety	2000 Edition ALL w/addendums

Code for Elevators and Escalators

Elevator Industry Field N/A ALL  
 Employees' Safety Handbook

<u>PUBLICATION</u>	<u>TITLE</u>	<u>DATE</u>	<u>PORTION</u>
NFPA 70	National Electrical Code	Current Edition	ALL
Public Law 94-580	Resource Conservation and Recovery Act of 1976 (RCRA)	1976	Sub title F
Executive Order 13101	Greening the Government through Waste Prevention, Recycling and Federal Acquisition	September 14, 1998	ALL
	Recovered Materials Advisory Notices (RMAN) <a href="http://www.epa.gov/cpg">http://www.epa.gov/cpg</a>	N/A	ALL
Comprehensive Procurement Guidelines (CPG)	USDA Bio-based Products List <a href="http://www.epa.gov/cpg/products.htm">http://www.epa.gov/cpg/products.htm</a>	N/A N/A	ALL ALL
OFPP Letter 92-4	Procurement of Environmentally Sound and Energy Efficient Products and Services	November 2, 1992	ALL
NFPA	National Fire Codes	Current Edition	ALL
NFPA 30	Flammable and Combustible Liquids Code Edition	Current	ALL
ANSI/ASME QEI - 1	Standard for the Qualification of elevator Inspectors	N/A	ALL
ANSI A13.1	Scheme for the Identification of Piping Systems	N/A	ALL
ASME	Checklist for Inspection of Electric Elevators, Checklist for Inspection of Hydraulic Elevators, Checklist for Inspection of Escalators and Moving Walks	N/A	ALL

<u>PUBLICATION</u>	<u>TITLE</u>	<u>DATE</u>	<u>PORTION</u>
NIH Contractor Performance System (CPS)		N/A	ALL
Public Law 93-579	Privacy Act	1974	ALL

---END---

**SECTION 21 13 13**  
**WET-PIPE SPRINKLER SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Design, installation and testing shall be in accordance with NFPA 13.
- B. The design and installation of a hydraulically calculated automatic wet-pipe system complete and ready for operation, for all portions of the 9<sup>th</sup> floor "B" BANK ELEVATOR MACHINE ROOM.

**1.2 RELATED WORK**

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Section 07 84 00, FIRESTOPPING.
- C. Section 09 91 00, PAINTING.
- D. Section 28 31 00, FIRE DETECTION AND ALARM.

**1.3 DESIGN CRITERIA**

- A. Design Basis Information: Provide design, materials, equipment, installation, inspection, and testing of the automatic sprinkler system in accordance with the requirements of NFPA 13.
  - 1. Perform hydraulic calculations in accordance with NFPA 13 utilizing the Area/Density method. Do not restrict design area reductions permitted for using quick response sprinklers throughout by the required use of standard response sprinklers in the areas identified in this section.
  - 2. Sprinkler Protection: Sprinkler hazard classifications shall be in accordance with NFPA 13. The hazard classification examples of uses and conditions identified in the Annex of NFPA 13 shall be mandatory for areas not listed below. Request clarification from the Government for any hazard classification not identified. To determining spacing and sizing, apply the following coverage classifications:
    - a. Ordinary Hazard Group 1 Occupancies: Laboratories, Mechanical Equipment Rooms, Transformer Rooms, Electrical Switchgear Rooms, Electric Closets, Elevator Machine Rooms and Repair Shops.
  - 3. Hydraulic Calculations: Calculated demand including hose stream requirements shall fall no less than 10 percent below the available water supply curve.
  - 4. Zoning:

- a. For each sprinkler zone provide a control valve, flow switch, and a test and drain assembly with pressure gauge. For buildings greater than two stories, provide a check valve at each control valve.
  - b. Sprinkler zones shall conform to the smoke barrier zones shown on the drawings.
5. Provide seismic protection in accordance with NFPA 13. Contractor shall submit load calculations for sizing of sway bracing for systems that are required to be protected against damage from earthquakes.

#### **1.4 SUBMITTALS**

- A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Prepare detailed working drawings that are signed by a NICET Level III or Level IV Sprinkler Technician or stamped by a Registered Professional Engineer licensed in the field of Fire Protection Engineering. As the Government review is for technical adequacy only, the installer remains responsible for correcting any conflicts with other trades and building construction that arise during installation. Partial submittals will not be accepted. Material submittals shall be approved prior to the purchase or delivery to the job site. Suitably bind submittals in notebooks or binders and provide an index referencing the appropriate specification section. In addition to the hard copies, provide submittal items in Paragraphs 1.4(A)1 through 1.4(A)5 electronically in pdf format on a compact disc or as directed by the COR. Submittals shall include, but not be limited to, the following:
1. Qualifications:
    - a. Provide a copy of the installing contractors fire sprinkler contractor's license.
    - b. Provide a copy of the NICET certification for the NICET Level III or Level IV Sprinkler Technician who prepared and signed the detailed working drawings unless the drawings are stamped by a Registered Professional Engineer licensed in the field of Fire Protection Engineering.
    - c. Provide documentation showing that the installer has been actively and successfully engaged in the installation of commercial automatic sprinkler systems for the past ten years.

2. Drawings: Submit detailed 1:100 (1/8 inch) scale (minimum) working drawings conforming to the Plans and Calculations chapter of NFPA 13. Drawings shall include graphical scales that allow the user to determine lengths when the drawings are reduced in size. Include a plan showing the piping to the water supply test location.
3. Manufacturer's Data Sheets: Provide data sheets for all materials and equipment proposed for use on the system. Include listing information and installation instructions in data sheets. Where data sheets describe items in addition to those proposed to be used for the system, clearly identify the proposed items on the sheet.
4. Calculation Sheets:
  - a. Submit hydraulic calculation sheets in tabular form conforming to the requirements and recommendations of the Plans and Calculations chapter of NFPA 13.
5. Valve Charts: Provide a valve chart that identifies the location of each control valve. Coordinate nomenclature and identification of control valves with COR. Where existing nomenclature does not exist, the chart shall include no less than the following: Tag ID No., Valve Size, Service (control valve, main drain, aux. drain, inspectors test valve, etc.), and Location.
6. Final Document Submittals: Provide as-built drawings, testing and maintenance instructions in accordance with the requirements in Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. In addition, submittals shall include, but not be limited to, the following:
  - a. A complete set of as-built drawings showing the installed system with the specific interconnections between the system switches and the fire alarm equipment. Provide a complete set in the formats as follows. Submit items 2 and 3 below on a compact disc or as directed by the COR.
    - 1) One full size (or size as directed by the COR) printed copy.
    - 2) One complete set in electronic pdf format.
    - 3) One complete set in AutoCAD format or a format as directed by the COR.
  - b. Material and Testing Certificate: Upon completion of the sprinkler system installation or any partial section of the system, including testing and flushing, provide a copy of a



completed Material and Testing Certificate as indicated in NFPA 13. Certificates shall be provided to document all parts of the installation.

- c. Operations and Maintenance Manuals that include step-by-step procedures required for system startup, operation, shutdown, and routine maintenance and testing. The manuals shall include the manufacturer's name, model number, parts list, and tools that should be kept in stock by the owner for routine maintenance, including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization, including address and telephone number, for each item of equipment.
- d. One paper copy of the Material and Testing Certificates and the Operations and Maintenance Manuals above shall be provided in a binder. In addition, these materials shall be provided in pdf format on a compact disc or as directed by the COR.
- e. Provide one additional copy of the Operations and Maintenance Manual covering the system in a flexible protective cover and mount in an accessible location adjacent to the riser or as directed by the COR.

#### **1.5 QUALITY ASSURANCE**

- A. **Installer Reliability:** The installer shall possess a valid fire sprinkler contractor's license. The installer shall have been actively and successfully engaged in the installation of commercial automatic sprinkler systems for the past ten years.
- B. **Materials and Equipment:** All equipment and devices shall be of a make and type listed by UL or approved by FM, or other nationally recognized testing laboratory for the specific purpose for which it is used. All materials, devices, and equipment shall be approved by the VA. All materials and equipment shall be free from defect. All materials and equipment shall be new unless specifically indicated otherwise on the contract drawings.

#### **1.6 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. National Fire Protection Association (NFPA):

- 13-13.....Installation of Sprinkler Systems
- 25-14.....Inspection, Testing, and Maintenance of Water-  
Based Fire Protection Systems
- 101-15.....Life Safety Code
- 170-15.....Fire Safety Symbols

- C. Underwriters Laboratories, Inc. (UL):  
Fire Protection Equipment Directory (2011)
- D. Factory Mutual Engineering Corporation (FM):  
Approval Guide

**PART 2 - PRODUCTS**

**2.1 PIPING & FITTINGS**

- A. Piping and fittings for private underground water mains shall be in accordance with NFPA 13.
  - 1. Pipe and fittings from inside face of building 300 mm (12 in.) above finished floor to a distance of approximately 1500 mm (5 ft.) outside building: Ductile Iron, flanged fittings and 316 stainless steel bolting.
- B. Piping and fittings for sprinkler systems shall be in accordance with NFPA 13.
  - 1. Plain-end pipe fittings with locking lugs or shear bolts are not permitted.
  - 2. Piping sizes 50 mm (2 inches) and smaller shall be black steel Schedule 40 with threaded end connections.
  - 3. Piping sizes 65 mm (2 ½ inches) and larger shall be black steel Schedule 10 with grooved connections. Grooves in Schedule 10 piping shall be rolled grooved only.
  - 4. Use nonferrous piping in MRI Scanning Rooms.
  - 5. Plastic piping shall not be permitted except for drain piping.
  - 6. Flexible sprinkler hose shall be FM Approved and limited to hose with threaded end fittings with a minimum inside diameter or 1-inch and a maximum length of 6-feet.

**2.2 VALVES**

- A. General:
  - 1. Valves shall be in accordance with NFPA 13.
  - 2. Do not use quarter turn ball valves for 50 mm (2 inch) or larger drain valves.

- B. Control Valve: The control valves shall be a listed indicating type. Control valves shall be UL Listed or FM Approved for fire protection installations. System control valve shall be rated for normal system pressure but in no case less than 175 PSI.
- C. Check Valve: Shall be of the swing type with a flanged cast iron body and flanged inspection plate.
- D. Automatic Ball Drips: Cast brass 20 mm (3/4 inch) in-line automatic ball drip with both ends threaded with iron pipe threads.

### **2.3 SPRINKLERS**

- A. Provide FM approved quick response sprinklers in all areas, except that standard response sprinklers shall be provided in elevator machine rooms.
- B. Temperature Ratings: In accordance with NFPA 13 except that sprinklers in elevator shafts and elevator machine rooms shall be no less than intermediate temperature rated and sprinklers in generator rooms shall be no less than high temperature rated.
- C. Provide sprinkler guards in accordance with NFPA 13 and when the elevation of the sprinkler head is less than 7 feet 6 inches above finished floor. The sprinkler guard shall be UL listed or FM approved for use with the corresponding sprinkler.

### **2.4 SPRINKLER SYSTEM SIGNAGE**

Rigid plastic, steel or aluminum signs with white lettering on a red background with holes for easy attachment. Sprinkler system signage shall be attached to the valve or piping with chain.

### **2.5 SWITCHES:**

- A. OS&Y Valve Supervisory Switches shall be in a weatherproof die cast/red baked enamel, oil resistant, aluminum housing with tamper resistant screws, 13 mm (1/2 inch) conduit entrance and necessary facilities for attachment to the valves. Provide two SPDT switches rated at 2.5 amps at 24 VDC.
- B. Water flow Alarm Switches: Mechanical, non-coded, non-accumulative retard and adjustable from 0 to 60 seconds minimum. Set flow switches at an initial setting between 20 and 30 seconds.
- C. Valve Supervisory Switches for Ball and Butterfly Valves: May be integral with the valve.

## **2.6 GAUGES**

Provide gauges as required by NFPA 13. Provide gauges where the normal pressure of the system is at the midrange of the gauge.

## **2.7 PIPE HANGERS, SUPPORTS AND RESTRAINT OF SYSTEM PIPING**

Pipe hangers, supports, and restraint of system piping shall be in accordance with NFPA 13.

## **2.8 WALL, FLOOR AND CEILING PLATES**

Provide chrome plated steel escutcheon plates.

## **2.9 VALVE TAGS**

Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 8 mm (1/4 inch) for service designation on 19 gage, 40 mm (1-1/2 inches) round brass disc, attached with brass "S" hook, brass chain, or nylon twist tie.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Installation shall be accomplished by the licensed contractor. Provide a qualified technician, experienced in the installation and operation of the type of system being installed, to supervise the installation and testing of the system.
- B. Installation of Piping: Accurately cut pipe to measurements established by the installer and work into place without springing or forcing. In any situation where bending of the pipe is required, use a standard pipe-bending template. Concealed piping in spaces that have finished ceilings. Where ceiling mounted equipment exists, such as in operating and radiology rooms, install sprinklers so as not to obstruct the movement or operation of the equipment. Sidewall heads may need to be utilized. In stairways, locate piping as near to the ceiling as possible to prevent tampering by unauthorized personnel and to provide a minimum headroom clearance of 2250 mm (seven feet six inches). Piping shall not obstruct the minimum means of egress clearances required by NFPA 101. Pipe hangers, supports, and restraint of system piping, shall be installed accordance with NFPA 13.
- C. Welding: Conform to the requirements and recommendations of NFPA 13.
- D. Drains: Provide drips and drains, including low point drains, in accordance with NFPA 13. Pipe drains to discharge at safe points outside of the building or to sight cones attached to drains of adequate size to readily carry the full flow from each drain under

maximum pressure. Do not provide a direct drain connection to sewer system or discharge into sinks. Install drips and drains where necessary and required by NFPA 13. The drain piping shall not be restricted or reduced and shall be of the same diameter as the drain collector.

- E. Supervisory Switches: Provide supervisory switches for sprinkler control valves.
- F. Waterflow Alarm Switches: Install waterflow alarm switches and valves in stairwells or other easily accessible locations.
- G. Inspector's Test Connection: Install and supply in accordance with NFPA 13, locate in a secured area, and discharge to the exterior of the building.
- H. Affix cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections to the respective waterflow switch or pipe connection near to the pipe from where they were cut.
- I. Provide escutcheon plates for exposed piping passing through walls, floors or ceilings.
- J. Clearances: For systems requiring seismic protection, piping that passes through floors or walls shall have penetrations sized 50 mm (2 inches) nominally larger than the penetrating pipe for pipe sizes 25 mm (1 inch) to 90 mm (3 ½ inches) and 100 mm (4 inches) nominally larger for penetrating pipe sizes 100 mm (4 inches) and larger.
- K. Sleeves: Provide for pipes passing through masonry or concrete. Provide space between the pipe and the sleeve in accordance with NFPA 13. Seal this space with a UL Listed through penetration fire stop material in accordance with Section 07 84 00, FIRESTOPPING. Where core drilling is used in lieu of sleeves, also seal space. Seal penetrations of walls, floors and ceilings of other types of construction, in accordance with Section 07 84 00, FIRESTOPPING.
- L. Where dry pendent sprinklers are used for freezers or similar spaces and they are connected to the wet pipe system, provide an EPDM boot around the dry pendent sprinkler on the heated side and securely seal to the pipe and freezer to prevent condensation from entering the freezer.
- M. Provide pressure gauges at each water flow alarm switch location and at each main drain connection.

- N. For each fire department connection, provide the symbolic sign given in NFPA 170 and locate 2400 to 3000 mm (8 to 10 feet) above each connection location. Size the sign to 450 by 450 mm (18 by 18 inches) with the symbol being at least 350 by 350 mm (14 by 14 inches).
- O. Firestopping shall be provided for all penetrations of fire resistance rated construction. Firestopping shall comply with Section 07 84 00, FIRESTOPPING.
- P. MRI Suite: Not applicable
- Q. Painting of Pipe: In finished areas where walls and ceilings have been painted, paint primed surfaces with two coats of paint to match adjacent surfaces, except paint valves and operating accessories with two coats of gloss red enamel. Exercise care to avoid painting sprinklers. Painting of sprinkler systems above suspended ceilings and in crawl spaces is not required. Painting shall comply with Section 09 91 00, PAINTING. Any painted sprinkler shall be replaced with a new sprinkler.
- R. Sprinkler System Signage: Provide rigid sprinkler system signage in accordance with NFPA 13 and NFPA 25. Sprinkler system signage shall include, but not limited to, the following:
1. Identification Signs:
    - a. Provide signage for each control valve, drain valve, sprinkler cabinet, and inspector's test.
    - b. Provide valve tags for each operable valve. Coordinate nomenclature and identification of operable valves with COR. Where existing nomenclature does not exist, the Tag Identification shall include no less than the following: (FP-B-F/SZ-#) Fire Protection, Building Number, Floor Number/Smoke Zone (if applicable), and Valve Number. (E.g., FP-500-1E-001) Fire Protection, Building 500, First Floor East, Number 001.)
  2. Instruction/Information Signs:
    - a. Provide signage for each control valve to indicate valve function and to indicate what system is being controlled.
    - b. Provide signage indicating the number and location of low point drains.
  3. Hydraulic Placards:

- a. Provide signage indicating hydraulic design information. The placard shall include location of the design area, discharge densities, required flow and residual pressure at the base of riser, occupancy classification, hose stream allowance, flow test information, and installing contractor. Locate hydraulic placard information signs at each alarm check valve.
- S. Repairs: Repair damage to the building or equipment resulting from the installation of the sprinkler system by the installer at no additional expense to the Government.
- T. Interruption of Service: There shall be no interruption of the existing sprinkler protection, water, electric, or fire alarm services without prior permission of the COR and VA safety officer. Contractor shall develop an interim fire protection program where interruptions involve occupied spaces. Request in writing at least one week prior to the planned interruption.

### **3.2 INSPECTION AND TEST**

- A. Preliminary Testing: Flush newly installed systems prior to performing hydrostatic tests in order to remove any debris which may have been left as well as ensuring piping is unobstructed. Hydrostatically test system, including the fire department connections, as specified in NFPA 13, in the presence of the Contracting Officers Representative (COR) or his designated representative. Test and flush underground water line prior to performing these hydrostatic tests.
- B. Final Inspection and Testing: Subject system to tests in accordance with NFPA 13, and when all necessary corrections have been accomplished, advise COR to schedule a final inspection and test. Connection to the fire alarm system shall have been in service for at least ten days prior to the final inspection, with adjustments made to prevent false alarms. Furnish all instruments, labor and materials required for the tests and provide the services of the installation foreman or other competent representative of the installer to perform the tests. Correct deficiencies and retest system as necessary, prior to the final acceptance. Include the operation of all features of the systems under normal operations in test

**3.3 INSTRUCTIONS**

Furnish the services of a competent instructor for not less than two hours for instructing personnel in the operation and maintenance of the system, on the dates requested by the COR.

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**SECTION 22 05 23**  
**GENERAL-DUTY VALVES FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

A. This section describes the requirements for general-duty valves for domestic water and sewer systems.

**1.2 RELATED WORK**

A. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.3 SUBMITTALS**

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Manufacturer's Literature and Data:

1. Valves.
2. Backflow Preventers.
3. Pressure Reducing Valves.
4. Backwater Valves
5. All items listed in Part 2 - Products.

**1.4 APPLICABLE PUBLICATIONS**

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):A536-84(R 2004)  
Standard Specification for Ductile Iron Castings

C. American Society of Sanitary Engineering (ASSE)  
ASSE 1003-01 (R 2003)...Performance Requirements for Water Pressure  
Reducing Valves

ASSE 1012-02.....Backflow Preventer with Intermediate  
Atmospheric Vent

ASSE 1013-05.....Reduced Pressure Principle Backflow Preventers  
and Reduced Pressure Fire Protection Principle  
Backflow Preventers

D. International Code Council (ICC)  
IPC-06 (R 2007).....International Plumbing Code

E. Manufacturers Standardization Society of the Valve and Fittings  
Industry, Inc. (MSS):  
SP-25-98.....Standard Marking System for Valves, Fittings,  
Flanges and Unions  
SP-67-02a (R 2004) Butterfly  
Valve of the Single flange Type (Lug Wafer)

SP-70-06.....Cast Iron Gate Valves, Flanged and Threaded  
Ends.  
SP-72-99.....Ball Valves With Flanged or Butt Welding For  
General Purpose  
SP-80-03.....Bronze Gate, Globe, Angle and Check Valves.  
SP-110-96.....Ball Valve Threaded, Socket Welding, Solder  
Joint, Grooved and Flared Ends

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Valves shall be prepared for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set angle, gate, and globe valves closed to prevent rattling.
  - 4. Set ball and plug valves open to minimize exposure of functional surfaces
  - 5. Set butterfly valves closed or slightly open.
  - 6. Block check valves in either closed or open position.
- B. Valves shall be prepared for storage as follows:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature.
- C. A sling shall be used for large valves. The sling shall be rigged to avoid damage to exposed parts. Hand wheels or stems shall not be used as lifting or rigging points.

#### **PART 2 - PRODUCTS**

##### **2.1 VALVES**

- A. Asbestos packing and gaskets are prohibited.
- B. Bronze valves shall be made with dezincification resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc shall not be permitted.
- C. Valves in insulated piping shall have 50 mm or DN50 (2 inch) stem extensions and extended handles of non-thermal conductive material that allows operating the valve without breaking the vapor seal or disturbing the insulation. Memory stops shall be fully adjustable after insulation is applied.

- D. Exposed Valves over 65 mm or DN65 (2-1/2 inches) installed at an elevation over 3.6 meters (12 feet) shall have a chain-wheel attachment to valve hand-wheel, stem, or other actuator.
- E. Ball valves, pressure regulating valves, gate valves, globe valves, and plug valves used to supply potable water shall meet the requirements of NSF 61.
- F. Shut-off:
  - 1. Cold, Hot and Re-circulating Hot Water:
    - a. 50 mm or DN50 (2 inches) and smaller: Ball, MSS SP-72, SP-110, Ball valve shall be full port three piece or two piece with a union design with adjustable stem package. Threaded stem designs are not allowed. The ball valve shall have a SWP rating of 1035 kPa (150 psig) and a CWP rating of 4140 kPa (600 psig). The body material shall be Bronze ASTM B584, Alloy C844. The ends shall be solder,
    - b. Less than 100 mm DN100 (4 inches): Butterfly shall have an iron body with EPDM seal and aluminum bronze disc. The butterfly valve shall meet MSS SP-67, type I standard. The butterfly valve shall have a SWP rating of 1380 kPa (200 psig). The valve design shall be lug type suitable for bidirectional dead-end service at rated pressure. The body material shall meet ASTM A 536, ductile iron.
    - c. 100 mm (DN100) (4 inches) and larger:
      - 1) Single flange, ductile iron butterfly valves: The single flanged butterfly valve shall meet the MSS SP-67 standard. The butterfly valve shall have a CWP rating of 1380 kPa (200 psig). The butterfly valve shall be lug type, suitable for bidirectional dead-end service at rated pressure without use of downstream flange. The body material shall comply with ASTM A536 ductile iron. The seat shall be EPDM with stainless steel disc and stem.
      - 2) Grooved end, ductile iron butterfly valves. The grooved butterfly valve shall meet the MSS SP-67 standard. The grooved butterfly valve shall have a CWP rating of 1380 kPa (200 psig). The valve materials shall be polyamide coated ductile iron conforming to ASTM A536 with two piece stainless

steel stem, EPDM encapsulated ductile iron disc, and EPDM seal. The butterfly valve shall be gear operated

G. Balancing:

1. Hot Water Re-circulating, 80 mm or DN80 (3 inches) and smaller manual balancing valve shall be of bronze body, brass ball construction with glass and carbon filled TFE seat rings and designed for positive shutoff. The manual balancing valve shall have differential pressure read-out ports across the valve seat area. The read out ports shall be fitting with internal EPT inserts and check valves. The valve body shall have 8 mm or DN8 NPT ( $\frac{1}{4}$ " NPT) tapped drain and purge port. The valves shall have memory stops that allow the valve to close for service and then reopened to set point without disturbing the balance position. All valves shall have calibrated nameplates to assure specific valve settings.
2. Larger than 80 mm or DN80 (3 inches): Manual balancing valves shall be of heavy duty cast iron flanged construction with 862 kPa (125 psi) flange connections. The flanged manual balancing valves shall have either a brass ball with glass and carbon filled TFE seal rings or fitted with a bronze seat, replaceable bronze disc with EPDM seal insert and stainless steel stem. The design pressure shall be 1207 kPa (175) at 121 deg C (250 deg F).

H. Check:

1. Check valves less than 80 mm or DN80 (3 inches) and smaller) shall be class 125, bronze swing check valves with non metallic Buna-N disc. The check valve shall meet MSS SP-80 Type 4 standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a Y pattern horizontal body design with bronze body material conforming to ASTM B 62, solder joints, and PTFE or TFE disc.
2. Larger than 100 mm or DN100 (4 inches and larger):
  - a. Check valves shall be class 125, iron swing check valve with lever and weight closure control. The check valve shall meet MSS SP-71 Type I standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a clear or full waterway body design with gray iron body material conforming to ASTM A 126, bolted bonnet, flanged ends, bronze trim.

- b. All check valves on the discharge side of submersible sump sumps shall have factory installed exterior level and weight with sufficient weight to prevent the check valve from hammering against the seat when the sump pump stops.

I. Globe:

- 1. 80 mm or DN80 (3 inches) or smaller: Class 150, bronze globe valve with non metallic disc. The globe valve shall meet MSS SP-80, Type 2 standard. The globe valve shall have a CWP rating of 2070 kPa (300 psig). The valve material shall be bronze with integral seal and union ring bonnet conforming to ASTM B 62 with solder ends, copper-silicon bronze stem, TPFPE or TFE disc, malleable iron hand wheel.
- 2. Larger than 80 mm or DN80 (3 inches): Similar to above, except with cast iron body and bronze trim, class 125, iron globe valve. The globe valve shall meet MSS SP-85, Type 1 standard. The globe valve shall have a CWP rating of 1380 kPa (200 psig). The valve material shall be gray iron with bolted bonnet conforming to ASTM A 126 with flanged ends, bronze trim, malleable iron handwheel.

**2.2 NOT USED**

**2.3 NOT USED**

**2.4 NOT USED**

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Valve interior shall be examined for cleanliness, freedom from foreign matter, and corrosion. Special packing materials shall be removed, such as blocks, used to prevent disc movement during shipping and handling.
- B. Valves shall be operated in positions from fully open to fully closed. Guides and seats shall be examined and made accessible by such operations.
- C. Threads on valve and mating pipe shall be examined for form and cleanliness.
- D. Mating flange faces shall be examined for conditions that might cause leakage. Bolting shall be checked for proper size, length, and material. Gaskets shall be verified for proper size and that its material composition is suitable for service and free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Valves shall be located for easy access and shall be provide with separate support. Valves shall be accessible with access doors when installed inside partitions or above hard ceilings.
- C. Valves shall be installed in horizontal piping with stem at or above center of pipe
- D. Valves shall be installed in a position to allow full stem movement.
- E. Install chain wheels on operators for [ball] [butterfly] [gate] and [globe] valves NPS 100 mm or DN100 (4 inches) and larger and more than [2400 mm (12 feet) above floor. Chains shall be extended to 1500 mm 3600 mm (60 inches) above finished floor.
- F. Check valves shall be installed for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.

### 3.3 ADJUSTING

- A. Valve packing shall be adjusted or replaced after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves shall be replaced if persistent leaking occurs.

- - E N D - - -

**SECTION 23 05 11**  
**COMMON WORK RESULTS FOR HVAC**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The requirements of this Section apply to all sections of Division 23.
- B. Definitions:
  - 1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
  - 2. Option or optional: Contractor's choice of an alternate material or method.
  - 3. COR: Contracting Officer's Representative.

**1.2 RELATED WORK**

- A. NOT USED
- B. Section 01 00 00, GENERAL REQUIREMENTS
- C. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES
- D. Section 23 07 11, HVAC, PLUMBING, and Boiler Plant Insulation
- E. Section 23 21 13, HYDRONIC PIPING
- F. Section 09 91 00, PAINTING

**1.3 QUALITY ASSURANCE**

- A. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in industrial and institutional HVAC
- B. Flow Rate Tolerance for HVAC Equipment: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- C. NOT USED
- D. Products Criteria:
  - 1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years (or longer as specified elsewhere). The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However, digital electronics devices,

software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions and/or additional requirements.

2. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
3. Conform to codes and standards as required by the specifications. Conform to local codes, if required by local authorities such as the natural gas supplier, if the local codes are more stringent than those specified. Refer any conflicts to the "COR".
4. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
5. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
6. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
7. Asbestos products or equipment or materials containing asbestos shall not be used.

E. Equipment Service Organizations:

1. HVAC: Products and systems shall be supported by service organizations that maintain a complete inventory of repair parts and are located within 50 miles to the site.

F. HVAC Mechanical Systems Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:

1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.

G. Execution (Installation, Construction) Quality:



1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to the "COR" for resolution. Provide written hard copies or computer files of manufacturer's installation instructions to the "COR" at least two weeks prior to commencing installation of any item. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations is a cause for rejection of the material.
  2. Provide complete layout drawings required by Paragraph, SUBMITTALS. Do not commence construction work on any system until the layout drawings have been approved.
- H. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with telephone numbers and e-mail addresses.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and with requirements in the individual specification sections.
- B. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
- C. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
- D. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.
- E. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient.
- F. Layout Drawings:

1. Submit complete consolidated and coordinated layout drawings for all new systems, and for existing systems that are in the same areas. Refer to Article, SUBCONTRACTS AND WORK COORDINATION.
  2. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8-inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance. Provide detailed layout drawings of all piping and duct systems.
  3. Do not install equipment foundations, equipment or piping until layout drawings have been approved.
  4. In addition, for HVAC systems, provide details of the following:
    - a. Mechanical equipment rooms.
    - b. Hangers, inserts, supports, and bracing.
    - c. Pipe sleeves.
    - d. Duct or equipment penetrations of floors, walls, ceilings, or roofs.
- G. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
1. Submit belt drive with the driven equipment. Submit selection data for specific drives when requested by the "COR".
  2. Submit electric motor data and variable speed drive data with the driven equipment.
  3. Equipment and materials identification.
  4. Fire-stopping materials.
  5. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
  6. Wall, floor, and ceiling plates.
- H. HVAC Maintenance Data and Operating Instructions:
1. Maintenance and operating manuals in accordance with GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
  2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.
- I. Provide copies of approved HVAC equipment submittals to the Testing, Adjusting and Balancing Subcontractor.

### 1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Conditioning, Heating and Refrigeration Institute (AHRI):  
430-2009.....Central Station Air-Handling Units
- C. American National Standard Institute (ANSI):  
B31.1-2007.....Power Piping
- D. Rubber Manufacturers Association (ANSI/RMA):  
IP-20-2007.....Specifications for Drives Using Classical  
V-Belts and Sheaves  
IP-21-2009.....Specifications for Drives Using Double-V  
(Hexagonal) Belts  
IP-22-2007.....Specifications for Drives Using Narrow V-Belts  
and Sheaves
- E. Air Movement and Control Association (AMCA):  
410-96.....Recommended Safety Practices for Air Moving  
Devices
- F. American Society of Mechanical Engineers (ASME):  
Boiler and Pressure Vessel Code (BPVC):  
Section I-2007.....Power Boilers  
Section IX-2007.....Welding and Brazing Qualifications  
Code for Pressure Piping:  
B31.1-2007.....Power Piping
- G. American Society for Testing and Materials (ASTM):  
A36/A36M-08.....Standard Specification for Carbon Structural  
Steel  
A575-96(2007).....Standard Specification for Steel Bars, Carbon,  
Merchant Quality, M-Grades  
E84-10.....Standard Test Method for Surface Burning  
Characteristics of Building Materials  
E119-09c.....Standard Test Methods for Fire Tests of Building  
Construction and Materials
- H. Manufacturers Standardization Society (MSS) of the Valve and Fittings  
Industry, Inc:  
SP-58-2009.....Pipe Hangers and Supports-Materials, Design and  
Manufacture, Selection, Application, and  
Installation

SP 69-2003.....Pipe Hangers and Supports-Selection and  
Application

SP 127-2001.....Bracing for Piping Systems, Seismic - Wind -  
Dynamic, Design, Selection, Application

I. National Electrical Manufacturers Association (NEMA):

MG-1-2009.....Motors and Generators

J. National Fire Protection Association (NFPA):

31-06.....Standard for Installation of Oil-Burning  
Equipment

54-09.....National Fuel Gas Code

70-08.....National Electrical Code

85-07.....Boiler and Combustion Systems Hazards Code

90A-09.....Standard for the Installation of Air  
Conditioning and Ventilating Systems

101-09.....Life Safety Code

**1.6 DELIVERY, STORAGE AND HANDLING**

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
2. Place damaged equipment in first class, new operating condition; or, replace same as determined and directed by the "COR". Such repair or replacement shall be at no additional cost to the Government.
3. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:

1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. Clean interior of all tanks prior to delivery for beneficial use by the Government.

4. Boilers shall be left clean following final internal inspection by Government insurance representative or inspector.
5. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

**1.7 JOB CONDITIONS - WORK IN EXISTING BUILDING**

- A. Building Operation: Government employees will be continuously operating and managing all facilities, including temporary facilities, that serve the medical center.
- B. Maintenance of Service: Schedule all work to permit continuous service as required by the medical center.
- C. Steam and Condensate Service Interruptions: Limited steam and condensate service interruptions, as required for interconnections of new and existing systems, will be permitted by the "COR" during periods when the demands are not critical to the operation of the medical center. These non-critical periods are limited to between 8 pm and 5 am in the appropriate off-season (if applicable). Provide at least one week advance notice to the "COR".
- D. Phasing of Work: Comply with all requirements shown on drawings or specified.
- E. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Maintain the interior of building at 18 degrees C (65 degrees F) minimum. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. No storm water or ground water leakage permitted. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all equipment being operated by VA.
- F. Acceptance of Work for Government Operation: As new facilities are made available for operation and these facilities are of beneficial use to the Government, inspections will be made and tests will be performed. Based on the inspections, a list of contract deficiencies will be issued to the Contractor. After correction of deficiencies as necessary for beneficial use, the Contracting Officer will process necessary acceptance and the equipment will then be under the control and operation of Government personnel.

**PART 2 - PRODUCTS**

**2.1 FACTORY-ASSEMBLED PRODUCTS**

- A. Provide maximum standardization of components to reduce spare part requirements.

- B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.
  - 1. All components of an assembled unit need not be products of same manufacturer.
  - 2. Constituent parts that are alike shall be products of a single manufacturer.
  - 3. Components shall be compatible with each other and with the total assembly for intended service.
  - 4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.
- C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.
- D. Major items of equipment, which serve the same function, must be the same make and model. Exceptions will be permitted if performance requirements cannot be met.

## **2.2 COMPATIBILITY OF RELATED EQUIPMENT**

Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational plant that conforms to contract requirements.

## **2.3 BELT DRIVES**

- A. Type: ANSI/RMA standard V-belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.
- B. Dimensions, rating and selection standards: ANSI/RMA IP-20 and IP-21.
- C. Minimum Horsepower Rating: Motor horsepower plus recommended ANSI/RMA service factor (not less than 20 percent) in addition to the ANSI/RMA allowances for pitch diameter, center distance, and arc of contact.
- D. Maximum Speed: 25 m/s (5000 feet per minute).
- E. Adjustment Provisions: For alignment and ANSI/RMA standard allowances for installation and take-up.
- F. Drives may utilize a single V-Belt (any cross section) when it is the manufacturer's standard.
- G. Multiple Belts: Matched to ANSI/RMA specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.

H. Sheaves and Pulleys:

1. Material: Pressed steel, or close grained cast iron.
2. Bore: Fixed or bushing type for securing to shaft with keys.
3. Balanced: Statically and dynamically.
4. Groove spacing for driving and driven pulleys shall be the same.

I. Drive Types, Based on ARI 435:

1. Provide adjustable-pitch or fixed-pitch drive as follows:
  - a. Fan speeds up to 1800 RPM: 7.5 kW (10 horsepower) and smaller.
  - b. Fan speeds over 1800 RPM: 2.2 kW (3 horsepower) and smaller.
2. Provide fixed-pitch drives for drives larger than those listed above.
3. The final fan speeds required to just meet the system CFM and pressure requirements, without throttling, shall be determined by adjustment of a temporary adjustable-pitch motor sheave or by fan law calculation if a fixed-pitch drive is used initially.

**2.4 DRIVE GUARDS**

- A. For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor to prevent damage to equipment and injury to personnel. Drive guards may be excluded where motors and drives are inside factory fabricated air handling unit casings.
- B. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gage sheet steel; ends shall be braked and drilled and attached to pump base with minimum of four 6 mm (1/4-inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.
- C. V-belt and sheave assemblies shall be totally enclosed, firmly mounted, non-resonant. Guard shall be an assembly of minimum 22-gage sheet steel and expanded or perforated metal to permit observation of belts. 25 mm (one-inch) diameter hole shall be provided at each shaft centerline to permit speed measurement.
- D. Materials: Sheet steel, cast iron, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.
- E. Access for Speed Measurement: 25 mm (One inch) diameter hole at each shaft center.

**2.5 LIFTING ATTACHMENTS**

Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand

any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

## **2.6 NOT USED**

## **2.7 NOT USED**

## **2.8 EQUIPMENT AND MATERIALS IDENTIFICATION**

- A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings and shown in the maintenance manuals. Identification for piping is specified in Section 09 91 00, PAINTING.
- B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 48 mm (3/16-inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.
- C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 48 mm (3/16-inch) high riveted or bolted to the equipment.
- D. Control Items: Label all temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.
- E. Valve Tags and Lists:
  1. HVAC and Boiler Plant: Provide for all valves other than for equipment in CONVECTION HEATING AND COOLING UNITS.
  2. Valve tags: Engraved black filled numbers and letters not less than 13 mm (1/2-inch) high for number designation, and not less than 6.4 mm(1/4-inch) for service designation on 19 gage 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
  3. Valve lists: Typed or printed plastic coated card(s), sized 216 mm(8-1/2 inches) by 280 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
  4. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color coded thumb tack in ceiling.

## **2.9 FIRESTOPPING**

FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping and ductwork. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION, for firestop pipe and duct insulation.



## 2.10 GALVANIZED REPAIR COMPOUND

Mil. Spec. DOD-P-21035B, paint form.

## 2.11 HVAC PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. NOT USED

B. Supports for Roof Mounted Items:

1. Equipment: Equipment rails shall be galvanized steel, minimum 1.3 mm (18 gauge), with integral baseplate, continuous welded corner seams, factory installed 50 mm by 100 mm (2 by 4) treated wood nailer, 1.3 mm (18 gauge) galvanized steel counter flashing cap with screws, built-in cant strip, (except for gypsum or tectum deck), minimum height 280 mm (11 inches). For surface insulated roof deck, provide raised cant strip to start at the upper surface of the insulation.
2. Pipe/duct pedestals: Provide a galvanized Unistrut channel welded to U-shaped mounting brackets which are secured to side of rail with galvanized lag bolts.

C. Pipe Supports: Comply with MSS SP-58. Type Numbers specified refer to this standard. For selection and application comply with MSS SP-69. Refer to SECTION 05 50 00 METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting requirements.

D. Attachment to Concrete Building Construction:

1. Concrete insert: MSS SP-58, Type 18.
2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 102 mm (four inches) thick when approved by the "COR" for each job condition.
3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 102 mm (four inches) thick when approved by the "COR" for each job condition.

E. Attachment to Steel Building Construction:

1. Welded attachment: MSS SP-58, Type 22.
2. Beam clamps: MSS SP-58, Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23mm (7/8-inch) outside diameter.

F. Hanger Rods: Hot-rolled steel, ASTM A36 or A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

- G. Hangers Supporting Multiple Pipes (Trapeze Hangers): Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts. Not permitted for steam supply and condensate piping.
1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
  2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4-inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13mm (1/2-inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.
- H. Supports for Piping Systems:
1. Select hangers sized to encircle insulation on insulated piping. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or preinsulated calcium silicate shields. Provide Type 40 insulation shield or preinsulated calcium silicate shield at all other types of supports and hangers including those for preinsulated piping.
  2. Piping Systems except High and Medium Pressure Steam (MSS SP-58):
    - a. Standard clevis hanger: Type 1; provide locknut.
    - b. Riser clamps: Type 8.
    - c. Wall brackets: Types 31, 32 or 33.
    - d. Roller supports: Type 41, 43, 44 and 46.
    - e. Saddle support: Type 36, 37 or 38.
    - f. Turnbuckle: Types 13 or 15. Preinsulate.
    - g. U-bolt clamp: Type 24.
    - h. Copper Tube:
      - 1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with non adhesive isolation tape to prevent electrolysis.
      - 2) For vertical runs use epoxy painted or plastic coated riser clamps.
      - 3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
      - 4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.

- i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.
3. High and Medium Pressure Steam (MSS SP-58):
  - a. Provide eye rod or Type 17 eye nut near the upper attachment.
  - b. Piping 50 mm (2 inches) and larger: Type 43 roller hanger. For roller hangers requiring seismic bracing provide a Type 1 clevis hanger with Type 41 roller attached by flat side bars.
- I. Pre-insulated Calcium Silicate Shields:
  1. Provide 360 degree water resistant high density 965 kPa (140 psi) compressive strength calcium silicate shields encased in galvanized metal.
  2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
  3. Shield thickness shall match the pipe insulation.
  4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
    - a. Shields for supporting chilled or cold water shall have insulation that extends a minimum of 1 inch past the sheet metal. Provide for an adequate vapor barrier in chilled lines.
    - b. The pre-insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS-SP 69. To support the load, the shields may have one or more of the following features: structural inserts 4138 kPa (600 psi) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36) wear plates welded to the bottom sheet metal jacket.
  5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.

#### **2.12 PIPE PENETRATIONS**

- A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.
- B. To prevent accidental liquid spills from passing to a lower level, provide the following:
  1. For sleeves: Extend sleeve 25 mm (one inch) above finished floor and provide sealant for watertight joint.
  2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.

3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.
- C. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of "COR".
  - D. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.
  - E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.
  - F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.
  - G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.
  - H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.
  - I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.
  - J. Sealant and Adhesives: Shall be as specified in JOINT SEALANTS.

#### **2.13 DUCT PENETRATIONS**

- A. Provide curbs for roof mounted piping, ductwork and equipment. Curbs shall be 18 inches high with continuously welded seams, built-in cant strip, interior baffle with acoustic insulation, curb bottom, hinged curb adapter.
- B. Provide firestopping for openings through fire and smoke barriers, maintaining minimum required rating of floor, ceiling or wall assembly. See FIRESTOPPING.

#### **2.14 SPECIAL TOOLS AND LUBRICANTS**

- A. Furnish, and turn over to the "COR", tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.
- B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.
- C. Refrigerant Tools: Provide system charging/Evacuation equipment, gauges, fittings, and tools required for maintenance of furnished equipment.
- D. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the "COR".
- E. Lubricants: A minimum of 0.95 L (one quart) of oil, and 0.45 kg (one pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

#### **2.15 WALL, FLOOR AND CEILING PLATES**

- A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.
- B. Thickness: Not less than 2.4 mm (3/32-inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025-inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035-inch) for larger pipe.
- C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

#### **2.16 ASBESTOS**

Materials containing asbestos are not permitted.

### **PART 3 - EXECUTION**

#### **3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING**

- A. Coordinate location of piping, sleeves, inserts, hangers, ductwork and equipment. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Prepare equipment layout drawings to coordinate proper location and personnel access of all facilities. Submit the drawings for review as required by Part 1. Follow manufacturer's published recommendations for installation methods not otherwise specified.
- B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access,

without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the drawings.

- C. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.
- D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.
- E. Cutting Holes:
  - 1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by "COR" where working area space is limited.
  - 2. Locate holes to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by "COR". If the Contractor considers it necessary to drill through structural members, this matter shall be referred to "COR" for approval.
  - 3. Do not penetrate membrane waterproofing.
- F. Interconnection of Instrumentation or Control Devices: Generally, electrical and pneumatic interconnections are not shown but must be provided.
- G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.
- H. Electrical and Pneumatic Interconnection of Controls and Instruments: This generally not shown but must be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Comply with NFPA-70.
- I. Protection and Cleaning:
  - 1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the "COR". Damaged or defective items in the opinion of the "COR", shall be replaced.

2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- J. Concrete and Grout: Use concrete and shrink compensating grout 25 MPa (3000 psi) minimum.
- K. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- L. Install steam piping expansion joints as per manufacturer's recommendations.
- M. Work in Existing Building:
1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
  2. As specified in GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.
  3. Cut required openings through existing masonry and reinforced concrete using diamond core drills. Use of pneumatic hammer type drills, impact type electric drills, and hand or manual hammer type drills, will be permitted only with approval of the "COR". Locate openings that will least effect structural slabs, columns, ribs or beams. Refer to the "COR" for determination of proper design for openings through structural sections and opening layouts approval, prior to cutting or drilling into structure. After "COR"'s approval, carefully cut opening through construction no larger than absolutely necessary for the required installation.
- N. Work in Animal Research Areas: Seal all pipe and duct penetrations with silicone sealant to prevent entrance of insects.
- O. Switchgear/Electrical Equipment Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Installation of piping, ductwork, leak

protection apparatus or other installations foreign to the electrical installation shall be located in the space equal to the width and depth of the equipment and extending from to a height of 1.8 m (6 ft.) above the equipment of to ceiling structure, whichever is lower (NFPA 70).

P. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost to the Government.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

**3.2 TEMPORARY PIPING AND EQUIPMENT**

- A. Continuity of operation of existing facilities will generally require temporary installation or relocation of equipment and piping.
- B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of Paragraph 3.1 apply.
- C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

**3.3 RIGGING**

- A. Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme.
- B. Alternative methods of equipment delivery may be offered by Contractor and will be considered by Government under specified restrictions of phasing and maintenance of service as well as structural integrity of the building.
- C. Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.
- D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility. Upon request, the Government will



check structure adequacy and advise Contractor of recommended restrictions.

- E. Contractor shall check all clearances, weight limitations and shall offer a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.
- F. Rigging plan and methods shall be referred to "COR" for evaluation prior to actual work.
- G. Restore building to original condition upon completion of rigging work.

#### **3.4 PIPE AND EQUIPMENT SUPPORTS**

- A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the "COR".
- B. Use of chain, wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above will not be permitted. Replace or thoroughly clean rusty products and paint with zinc primer.
- C. Use hanger rods that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2-inch) clearance between pipe or piping covering and adjacent work.
- D. HVAC Horizontal Pipe Support Spacing: Refer to MSS SP-69. Provide additional supports at valves, strainers, in-line pumps and other heavy components. Provide a support within one foot of each elbow.
- E. HVAC Vertical Pipe Supports:
  - 1. Up to 150 mm (6-inch pipe), 9 m (30 feet) long, bolt riser clamps to the pipe below couplings, or welded to the pipe and rests supports securely on the building structure.
  - 2. Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure.
- F. Overhead Supports:
  - 1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
  - 2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
  - 3. Tubing and capillary systems shall be supported in channel troughs.
- G. Floor Supports:

1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Anchor and dowel concrete bases and structural systems to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
2. Do not locate or install bases and supports until equipment mounted thereon has been approved. Size bases to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Boiler foundations shall have horizontal dimensions that exceed boiler base frame dimensions by at least 150 mm (6 inches) on all sides. Refer to structural drawings. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a granular material to permit alignment and realignment.
4. For seismic anchoring, refer to SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

### **3.5 MECHANICAL DEMOLITION**

- A. Rigging access, other than indicated on the drawings, shall be provided by the Contractor after approval for structural integrity by the "COR". Such access shall be provided without additional cost or time to the Government. Where work is in an operating plant, provide approved protection from dust and debris at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.
- B. In an operating facility, maintain the operation, cleanliness and safety. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Confine the work to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Do not permit debris to accumulate in the area to the detriment of plant operation. Perform all flame cutting to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. Perform all work in accordance with recognized fire protection standards. Inspection will be made by personnel of the VA Medical Center, and Contractor shall follow all directives of the RE or COR with regard to rigging, safety, fire safety, and maintenance of operations.

- C. Completely remove all piping, wiring, conduit, and other devices associated with the equipment not to be re-used in the new work. This includes all pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. Seal all openings, after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.
- D. All valves including gate, globe, ball, butterfly and check, all pressure gages and thermometers with wells shall remain Government property and shall be removed and delivered to "COR" and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate.

### **3.6 CLEANING AND PAINTING**

- A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.
- B. In addition, the following special conditions apply:
  - 1. Cleaning shall be thorough. Use solvents, cleaning materials and methods recommended by the manufacturers for the specific tasks. Remove all rust prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
  - 2. Material And Equipment Not To Be Painted Includes:
    - a. Motors, controllers, control switches, and safety switches.
    - b. Control and interlock devices.
    - c. Regulators.
    - d. Pressure reducing valves.
    - e. Control valves and thermostatic elements.
    - f. Lubrication devices and grease fittings.
    - g. Copper, brass, aluminum, stainless steel and bronze surfaces.
    - h. Valve stems and rotating shafts.
    - i. Pressure gauges and thermometers.

- j. Glass.
- k. Name plates.
- 3. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.
- 4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same color as utilized by the pump manufacturer
- 5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats.
- 6. Paint shall withstand the following temperatures without peeling or discoloration:
  - a. Condensate and feedwater -- 38 degrees C (100 degrees F) on insulation jacket surface and 120 degrees C (250 degrees F) on metal pipe surface.
  - b. Steam -- 52 degrees C (125 degrees F) on insulation jacket surface and 190 degrees C (375 degrees F) on metal pipe surface.
- 7. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.

### **3.7 IDENTIFICATION SIGNS**

- A. Provide laminated plastic signs, with engraved lettering not less than 5 mm (3/16-inch) high, designating functions, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.
- B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance.
- C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

### **3.8 MOTOR AND DRIVE ALIGNMENT**

- A. Belt Drive: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.
- B. Direct-connect Drive: Securely mount motor in accurate alignment so that shafts are free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures.

### **3.9 LUBRICATION**

- A. Lubricate all devices requiring lubrication prior to initial operation. Field-check all devices for proper lubrication.

- B. Equip all devices with required lubrication fittings or devices. Provide a minimum of one liter (one quart) of oil and 0.5 kg (one pound) of grease of manufacturer's recommended grade and type for each different application; also provide 12 grease sticks for lubricated plug valves. Deliver all materials to "COR" in unopened containers that are properly identified as to application.
- C. Provide a separate grease gun with attachments for applicable fittings for each type of grease applied.
- D. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

**3.10 NOT USED**

**3.11 STARTUP AND TEMPORARY OPERATION**

Start up equipment as described in equipment specifications. Verify that vibration is within specified tolerance prior to extended operation. Temporary use of equipment is specified in GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

**3.12 OPERATING AND PERFORMANCE TESTS**

- A. Prior to the final inspection, perform required tests as specified in GENERAL REQUIREMENTS and submit the test reports and records to the "COR".
- B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.
- C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then make performance tests for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work.

**3.13 INSTRUCTIONS TO VA PERSONNEL**

Provide in accordance with Article, INSTRUCTIONS, GENERAL REQUIREMENTS.

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**SECTION 23 05 93**  
**TESTING, ADJUSTING, AND BALANCING FOR HVAC**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:
1. Planning systematic TAB procedures.
  2. Design Review Report.
  3. Systems Inspection report.
  4. Duct Air Leakage test report.
  5. Systems Readiness Report.
  6. Balancing air and water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
  7. Vibration and sound measurements.
  8. Recording and reporting results.
- B. Definitions:
1. Basic TAB used in this Section: Chapter 37, "Testing, Adjusting and Balancing" of 2007 ASHRAE Handbook, "HVAC Applications".
  2. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
  3. AABC: Associated Air Balance Council.
  4. NEBB: National Environmental Balancing Bureau.
  5. Hydronic Systems: Includes chilled water, and glycol-water systems.
  6. Air Systems: Includes all outside air, supply air, return air, exhaust air and relief air systems.
  7. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

**1.2 RELATED WORK**

- A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General Mechanical Requirements.
- B. NOT USED
- C. Section 23 07 11, HVAC, AND BOILER PLANT INSULATION: Piping and Equipment Insulation.
- D. Section 23 21 13, HYDRONIC PIPING

### 1.3 QUALITY ASSURANCE

- A. Refer to Articles, Quality Assurance and Submittals, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC,
- B. Qualifications:
1. TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.
  2. The TAB agency shall be either a certified member of AABC or certified by the NEBB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the Contracting Officer's Representative and submit another TAB firm for approval. Any agency that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work performed by the predecessor agency.
  3. TAB Specialist: The TAB specialist shall be either a member of AABC or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the Contracting Officer's Representative and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by an approved successor.

4. TAB Specialist shall be identified by the General Contractor within 60 days after the notice to proceed. The TAB specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the Contracting Officer's Representative. The responsibilities would specifically include:
    - a. Shall directly supervise all TAB work.
    - b. Shall sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC or NEBB.
    - c. Would follow all TAB work through its satisfactory completion.
    - d. Shall provide final markings of settings of all HVAC adjustment devices.
    - e. Permanently mark location of duct test ports.
  5. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity to this project. Qualifications must be certified by the TAB agency in writing. The lead technician shall be certified by AABC or NEBB
- C. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose.
- D. Tab Criteria:
1. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by ASHRAE Handbook "HVAC Applications" Chapter 36, and requirements stated herein shall be the basis for planning, procedures, and reports.
  2. Flow rate tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow ASHRAE Handbook "HVAC Applications", Chapter 36, as a guideline. Air Filter resistance during tests, artificially imposed if necessary, shall be at least 100 percent of manufacturer recommended change over pressure drop values for pre-filters and after-filters.



- a. Air handling unit and all other fans, cubic meters/min (cubic feet per minute): Minus 0 percent to plus 10 percent.
  - b. Air terminal units (maximum values): Minus 2 percent to plus 10 percent.
  - c. Exhaust hoods/cabinets: 0 percent to plus 10 percent.
  - d. Minimum outside air: 0 percent to plus 10 percent.
  - e. Individual room air outlets and inlets, and air flow rates not mentioned above: Minus 5 percent to plus 10 percent except if the air to a space is 100 CFM or less the tolerance would be minus 5 to plus 5 percent.
  - f. Heating hot water pumps and hot water coils: Minus 5 percent to plus 5 percent.
  - g. Chilled water and condenser water pumps: Minus 0 percent to plus 5 percent.
  - h. Chilled water coils: Minus 0 percent to plus 5 percent.
3. Systems shall be adjusted for energy efficient operation as described in PART 3.
  4. Typical TAB procedures and results shall be demonstrated to the Contracting Officer's Representative for one air distribution system (including all fans, three terminal units, three rooms randomly selected by the Contracting Officer's Representative) and one hydronic system (pumps and three coils) as follows:
    - a. When field TAB work begins.
    - b. During each partial final inspection and the final inspection for the project if requested by VA.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Submit names and qualifications of TAB agency and TAB specialists within 60 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.
- C. For use by the Contracting Officer's Representative staff, submit one complete set of applicable AABC or NEBB publications that will be the basis of TAB work.
- D. Submit Following for Review and Approval:

1. Design Review Report within 90 days for conventional design projects after the system layout on air and water side is completed by the Contractor.
  2. Systems inspection report on equipment and installation for conformance with design.
  3. Duct Air Leakage Test Report.
  4. Systems Readiness Report.
  5. Intermediate and Final TAB reports covering flow balance and adjustments, performance tests, vibration tests and sound tests.
  6. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.
- E. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area.

#### **1.5 APPLICABLE PUBLICATIONS**

- A. The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the acronym of the organization.
- B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):  
2007 .....HVAC Applications ASHRAE Handbook, Chapter 37,  
Testing, Adjusting, and Balancing and Chapter  
47, Sound and Vibration Control
- C. Associated Air Balance Council (AABC):  
2002.....AABC National Standards for Total System  
Balance
- D. National Environmental Balancing Bureau (NEBB):  
7<sup>th</sup> Edition 2005 .....Procedural Standards for Testing, Adjusting,  
Balancing of Environmental Systems  
2nd Edition 2006 .....Procedural Standards for the Measurement of  
Sound and Vibration  
3<sup>rd</sup> Edition 2009 .....Procedural Standards for Whole Building Systems  
Commissioning of New Construction
- E. Sheet Metal and Air Conditioning Contractors National Association  
(SMACNA):  
3<sup>rd</sup> Edition 2002 .....HVAC SYSTEMS Testing, Adjusting and Balancing

**PART 2 - PRODUCTS**

**2.1 PLUGS**

Provide plastic plugs to seal holes drilled in ductwork for test purposes.

**2.2 INSULATION REPAIR MATERIAL**

See Section 23 07 11, HVAC and BOILER PLANT INSULATION Provide for repair of insulation removed or damaged for TAB work.

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. Refer to TAB Criteria in Article, Quality Assurance.
- B. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.

**3.2 DESIGN REVIEW REPORT**

The TAB Specialist shall review the Contract Plans and specifications and advise the Contracting Officer's Representative of any design deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

**3.3 SYSTEMS INSPECTION REPORT**

- A. Inspect equipment and installation for conformance with design.
- B. The inspection and report is to be done after air distribution equipment is on site and duct installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.
- C. Reports: Follow check list format developed by AABC, NEBB or SMACNA, supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. Check air terminal unit installation including their duct sizes and routing.

**3.4 NOT USED**

**3.5 SYSTEM READINESS REPORT**

- A. NOT USED

- B. Inspect each System to ensure that it is complete including installation and operation of controls. Submit report to COR in standard format and forms prepared and or approved by the Commissioning Agent.
- C. Verify that all items such as ductwork piping, ports, terminals, connectors, etc., that is required for TAB are installed. Provide a report to the Contracting Officer's Representative.

### **3.6 TAB REPORTS**

- A. NOT USED
- B. The TAB contractor shall provide raw data immediately in writing to the Contracting Officer's Representative if there is a problem in achieving intended results before submitting a formal report.
- C. If over 20 percent of readings in the intermediate report fall outside the acceptable range, the TAB report shall be considered invalid and all contract TAB work shall be repeated and re-submitted for approval at no additional cost to the owner.
- D. Do not proceed with the remaining systems until intermediate report is approved by the Contracting Officer's Representative.

### **3.7 TAB PROCEDURES**

- A. Tab shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC or NEBB.
- B. General: During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.
- C. Coordinate TAB procedures with existing systems and any phased construction completion requirements for the project. Provide TAB reports for each phase of the project prior to partial final inspections of each phase of the project. Return existing areas outside the work area to pre constructed conditions.
- D. Allow 7 days time in construction schedule for TAB and submission of all reports for an organized and timely correction of deficiencies.
- E. Air Balance and Equipment Test: Include fans.
  - 1. Artificially load air filters by partial blanking to produce air pressure drop of manufacturer's recommended pressure drop.

2. Adjust fan speeds to provide design air flow. V-belt drives, including fixed pitch pulley requirements, are specified in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
3. Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other controls function properly.
4. NOT USED
5. Record final measurements for air handling equipment performance data sheets.

### **3.8 VIBRATION TESTING**

- A. Furnish instruments and perform vibration measurements as specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT. Field vibration balancing is specified in Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide measurements for all rotating HVAC equipment of 373 watts (1/2 horsepower) and larger, including centrifugal/screw compressors, cooling towers, pumps, fans and motors.
- B. Record initial measurements for each unit of equipment on test forms and submit a report to the Contracting Officer's Representative. Where vibration readings exceed the allowable tolerance Contractor shall be directed to correct the problem. The TAB agency shall verify that the corrections are done and submit a final report to the Contracting Officer's Representative.

### **3.9 NOT USED**

### **3.10 MARKING OF SETTINGS**

Following approval of Tab final Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the Contracting Officer's Representative.

### **3.11 IDENTIFICATION OF TEST PORTS**

The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

**3.12 PHASING**

- A. Phased Projects: Testing and Balancing Work to follow project with areas shall be completed per the project phasing. Upon completion of the project all areas shall have been tested and balanced per the contract documents.
- B. Existing Areas: Systems that serve areas outside of the project scope shall not be adversely affected. Measure existing parameters where shown to document system capacity.

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SECTION 23 07 11  
HVAC AND BOILER PLANT INSULATION

INSULATION WORK IS ONLY REQUIRED ON NEW OR REVISED SURFACES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Field applied insulation for thermal efficiency and condensation control for
1. HVAC piping and equipment.
  2. Re-insulation of HVAC piping, and equipment.
- B. Definitions
1. ASJ: All service jacket, white finish facing or jacket.
  2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
  3. Cold: Equipment, ductwork or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
  4. Concealed: Ductwork and piping above ceilings and in chases, and pipe spaces.
  5. Exposed: Piping, ductwork, and equipment exposed to view in finished areas including mechanical and electrical equipment rooms or exposed to outdoor weather. Attics and crawl spaces where air handling units are located are considered to be mechanical rooms. Shafts, chases, interstitial spaces, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
  6. FSK: Foil-scrim-kraft facing.
  7. Hot: HVAC Ductwork handling air at design temperature above 16 degrees C (60 degrees F); HVAC equipment or piping handling media above 41 degrees C (105 degrees F); Boiler Plant breechings and stack temperature range 150-370 degrees C(300-700 degrees F) and piping media and equipment 32 to 230 degrees C(90 to 450 degrees F).
  8. Density:  $\text{kg/m}^3$  - kilograms per cubic meter (Pcf - pounds per cubic foot).
  9. Runouts: Branch pipe connections up to 25-mm (one-inch) nominal size to fan coil units or reheat coils for terminal units.
  10. Thermal conductance: Heat flow rate through materials.
    - a. Flat surface: Watt per square meter (BTU per hour per square foot).
    - b. Pipe or Cylinder: Watt per square meter (BTU per hour per linear foot).

11. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
12. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders shall have a maximum published permeance of 0.1 perms and vapor barriers shall have a maximum published permeance of 0.001 perms.
13. HPS: High pressure steam (415 kPa [60 psig] and above).
14. HPR: High pressure steam condensate return.
15. MPS: Medium pressure steam (110 kPa [16 psig] thru 414 kPa [59 psig]).
16. MPR: Medium pressure steam condensate return.
17. LPS: Low pressure steam (103 kPa [15 psig] and below).
18. LPR: Low pressure steam condensate gravity return.
19. PC: Pumped condensate.
20. HWH: Hot water heating supply.
21. HWHR: Hot water heating return.
22. GH: Hot glycol-water heating supply.
23. GHR: Hot glycol-water heating return.
24. FWPD: Feedwater pump discharge.
25. FWPS: Feedwater pump suction.
26. CTPD: Condensate transfer pump discharge.
27. CTPS: Condensate transfer pump suction.
28. VR: Vacuum condensate return.
29. CPD: Condensate pump discharge.
30. R: Pump recirculation.
31. FOS: Fuel oil supply.
32. FOR: Fuel oil return.
33. CW: Cold water.
34. SW: Soft water.
35. HW: Hot water.
36. CH: Chilled water supply.
37. CHR: Chilled water return.
38. GC: Chilled glycol-water supply.
39. GCR: Chilled glycol-water return.



40. RS: Refrigerant suction.

41. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

## 1.2 RELATED WORK

- A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.
- B. Section 23 21 13, HYDRONIC PIPING

## 1.3 QUALITY ASSURANCE

- A. Refer to article QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. Criteria:
  - 1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.10.2.6, and 5.4.6.4, parts of which are quoted as follows:

**4.3.3.1** Pipe insulation and coverings, duct coverings, duct linings, vapor retarder facings, adhesives, fasteners, tapes, and supplementary materials added to air ducts, plenums, panels, and duct silencers used in duct systems, unless otherwise provided for in 4.3.3.1.1 or 4.3.3.1.2., shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.

**4.3.3.1.1** Where these products are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state. (See 4.2.4.2.)

**4.3.3.1.2** The flame spread and smoke developed index requirements of 4.3.3.1.1 shall not apply to air duct weatherproof coverings where they are located entirely outside of a building, do not penetrate a wall or roof, and do not create an exposure hazard.

**4.3.3.2** Closure systems for use with rigid and flexible air ducts tested in accordance with UL 181, Standard for Safety Factory-Made Air Ducts and Air Connectors, shall have been tested, listed, and used in accordance with the conditions of their listings, in accordance with one of the following:

(1) UL 181A, Standard for Safety Closure Systems for Use with Rigid Air Ducts and Air Connectors

(2) UL 181B, Standard for Safety Closure Systems for Use with Flexible Air Ducts and Air Connectors

**4.3.3.3** Air duct, panel, and plenum coverings and linings, and pipe insulation and coverings shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe

covering, ASTM C 411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service.

4.3.3.3.1 In no case shall the test temperature be below 121°C (250°F).

4.3.3.4 Air duct coverings shall not extend through walls or floors that are required to be fire stopped or required to have a fire resistance rating, unless such coverings meet the requirements of 5.4.6.4.

4.3.3.5\* Air duct linings shall be interrupted at fire dampers to prevent interference with the operation of devices.

4.3.3.6 Air duct coverings shall not be installed so as to conceal or prevent the use of any service opening.

4.3.10.2.6 Materials exposed to the airflow shall be noncombustible or limited combustible and have a maximum smoke developed index of 50 or comply with the following.

4.3.10.2.6.1 Electrical wires and cables and optical fiber cables shall be listed as noncombustible or limited combustible and have a maximum smoke developed index of 50 or shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

4.3.10.2.6.4 Optical-fiber and communication raceways shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 2024, Standard for Safety Optical-Fiber Cable Raceway.

4.3.10.2.6.6 Supplementary materials for air distribution systems shall be permitted when complying with the provisions of 4.3.3.

5.4.6.4 Where air ducts pass through walls, floors, or partitions that are required to have a fire resistance rating and where fire dampers are not required, the opening in the construction around the air duct shall be as follows:

(1) Not exceeding a 25.4 mm (1 in.) average clearance on all sides

(2) Filled solid with an approved material capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to the time-temperature fire conditions required for fire barrier penetration as specified in *NFPA 251, Standard Methods of Tests of Fire Endurance of Building Construction and Materials*

2. Test methods: ASTM E84, UL 723, or NFPA 255.

3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal

- conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.
- C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Shop Drawings:
  1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.
    - a. Insulation materials: Specify each type used and state surface burning characteristics.
    - b. Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed ductwork, casings and equipment.
    - c. Insulation accessory materials: Each type used.
    - d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
    - e. Make reference to applicable specification paragraph numbers for coordination.
- C. Samples:
  1. Each type of insulation: Minimum size 100 mm (4 inches) square for board/block/ blanket; 150 mm (6 inches) long, full diameter for round types.
  2. Each type of facing and jacket: Minimum size 100 mm (4 inches square).
  3. Each accessory material: Minimum 120 ML (4 ounce) liquid container or 120 gram (4 ounce) dry weight for adhesives / cement / mastic.

### 1.5 STORAGE AND HANDLING OF MATERIAL

Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

### 1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. Federal Specifications (Fed. Spec.):
  - L-P-535E (2)- 99.....Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.
- C. Military Specifications (Mil. Spec.):
  - MIL-A-3316C (2)-90.....Adhesives, Fire-Resistant, Thermal Insulation
  - MIL-A-24179A (1)-87.....Adhesive, Flexible Unicellular-Plastic Thermal Insulation
  - MIL-C-19565C (1)-88.....Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier
  - MIL-C-20079H-87.....Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass
- D. American Society for Testing and Materials (ASTM):
  - A167-99(2004).....Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  - B209-07.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
  - C411-05.....Standard test method for Hot-Surface Performance of High-Temperature Thermal Insulation
  - C449-07.....Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
  - C533-09.....Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

- C534-08.....Standard Specification for Preformed Flexible  
Elastomeric Cellular Thermal Insulation in  
Sheet and Tubular Form
- C547-07.....Standard Specification for Mineral Fiber pipe  
Insulation
- C552-07.....Standard Specification for Cellular Glass  
Thermal Insulation
- C553-08.....Standard Specification for Mineral Fiber  
Blanket Thermal Insulation for Commercial and  
Industrial Applications
- C585-09.....Standard Practice for Inner and Outer Diameters  
of Rigid Thermal Insulation for Nominal Sizes  
of Pipe and Tubing (NPS System) R (1998)
- C612-10.....Standard Specification for Mineral Fiber Block  
and Board Thermal Insulation
- C1126-04.....Standard Specification for Faced or Unfaced  
Rigid Cellular Phenolic Thermal Insulation
- C1136-10.....Standard Specification for Flexible, Low  
Permeance Vapor Retarders for Thermal  
Insulation
- D1668-97a (2006).....Standard Specification for Glass Fabrics (Woven  
and Treated) for Roofing and Waterproofing
- E84-10.....Standard Test Method for Surface Burning  
Characteristics of Building  
Materials
- E119-09c.....Standard Test Method for Fire Tests of Building  
Construction and Materials
- E136-09b.....Standard Test Methods for Behavior of Materials  
in a Vertical Tube Furnace at 750 degrees C  
(1380 F)
- E. National Fire Protection Association (NFPA):
- 90A-09.....Standard for the Installation of Air  
Conditioning and Ventilating Systems
- 96-08.....Standards for Ventilation Control and Fire  
Protection of Commercial Cooking Operations
- 101-09.....Life Safety Code

251-06.....Standard methods of Tests of Fire Endurance of  
Building Construction Materials

255-06.....Standard Method of tests of Surface Burning  
Characteristics of Building Materials

F. Underwriters Laboratories, Inc (UL):

723.....UL Standard for Safety Test for Surface Burning  
Characteristics of Building Materials with  
Revision of 09/08

G. Manufacturer's Standardization Society of the Valve and Fitting  
Industry (MSS):

SP58-2009.....Pipe Hangers and Supports Materials, Design,  
and Manufacture

**PART 2 - PRODUCTS**

**2.1 MINERAL FIBER OR FIBER GLASS**

A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m<sup>3</sup> (3 pcf), k = 0.037 (0.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F) with foil scrim (FSK) facing.

B. NOT USED

C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.037 (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (450 degrees F) with an all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.

**2.2 MINERAL WOOL OR REFRACTORY FIBER**

A. Comply with Standard ASTM C612, Class 3, 450 degrees C (850 degrees F).

**2.3 RIGID CELLULAR PHENOLIC FOAM**

A. Preformed (molded) pipe insulation, ASTM C1126, type III, grade 1, k = 0.021(0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.

B. Equipment and Duct Insulation, ASTM C 1126, type II, grade 1, k = 0.021 (0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with rigid cellular phenolic insulation and covering, and all service vapor retarder jacket.

**2.4 CELLULAR GLASS CLOSED-CELL**

- A. Comply with Standard ASTM C177, C518, density 120 kg/m<sup>3</sup> (7.5 pcf) nominal, k = 0.033 (0.29) at 24 degrees C (75 degrees F).
- B. Pipe insulation for use at temperatures up to 200 degrees C (400 degrees F) with all service vapor retarder jacket.

**2.5 POLYISOCYANURATE CLOSED-CELL RIGID**

- A. Preformed (fabricated) pipe insulation, ASTM C591, type IV, K=0.027(0.19) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for use at temperatures up to 149 degree C (300 degree F) with factory applied PVDC or all service vapor retarder jacket with polyvinyl chloride premolded fitting covers.
- B. Equipment and duct insulation, ASTM C 591, type IV, K=0.027(0.19) at 24 degrees C (75 degrees F), for use at temperatures up to 149 degrees C (300 degrees F) with PVDC or all service jacket vapor retarder jacket.

**2.6 FLEXIBLE ELASTOMERIC CELLULAR THERMAL**

ASTM C177, C518, k = 0.039 (0.27) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (200 degrees F). No jacket required.

**2.7 NOT USED**

**2.8 CALCIUM SILICATE**

- A. Preformed pipe Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.
- B. Premolded Pipe Fitting Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.
- C. Equipment Insulation: ASTM C533, Type I and Type II
- D. Characteristics:

<b>Insulation Characteristics</b>		
<b>ITEMS</b>	<b>TYPE I</b>	<b>TYPE II</b>
Temperature, maximum degrees C (degrees F)	649 (1200)	927 (1700)
Density (dry), Kg/m <sup>3</sup> (lb/ ft <sup>3</sup> )	232 (14.5)	288 (18)
Thermal conductivity: Min W/ m K (Btu in/h ft <sup>2</sup> degrees F)@ mean temperature of 93 degrees C	0.059 (0.41)	0.078 (0.540)

(200 degrees F)		
Surface burning characteristics:		
Flame spread Index, Maximum	0	0
Smoke Density index, Maximum	0	0

**2.9 INSULATION FACINGS AND JACKETS**

- A. Vapor Retarder, higher strength with low water permeance  $\leq$  0.02 or less perm rating, Beach puncture 50 units for insulation facing on exposed ductwork, casings and equipment, and for pipe insulation jackets. Facings and jackets shall be all service type (ASJ) or PVDC Vapor Retarder jacketing.
- B. ASJ jacket shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 50 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75 mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.
- C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: Foil-Scrim-Kraft (FSK) or PVDC vapor retarder jacketing type for concealed ductwork and equipment.
- D. Field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping and ductwork as well as on interior piping and ductwork exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.) in high humidity areas conveying fluids below ambient temperature. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.
- E. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2000 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.



- F. Factory composite materials may be used provided that they have been tested and certified by the manufacturer.
- G. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be polyvinyl chloride (PVC) conforming to Fed Spec L-P-335, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape.
- H. Aluminum Jacket-Piping systems: ASTM B209, 3003 alloy, H-14 temper, 0.6 mm (0.023 inch) minimum thickness with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory-fabricated to match shape of fitting and of 0.6 mm (0.024) inch minimum thickness aluminum. Fittings shall be of same construction as straight run jackets but need not be of the same alloy. Factory-fabricated stainless steel bands shall be installed on all circumferential joints. Bands shall be 13 mm (0.5 inch) wide on 450 mm (18 inch) centers. System shall be weatherproof if utilized for outside service.

I. NOT USED

**2.10 NOT USED**

**2.11 PIPE COVERING PROTECTION SADDLES**

- A. Cold pipe support: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m<sup>3</sup> (3.0 pcf).

<b>Nominal Pipe Size and Accessories Material (Insert Blocks)</b>	
Nominal Pipe Size mm (inches)	Insert Blocks mm (inches)
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long
200 (8), 250 (10), 300 (12)	225 (9) long
350 (14), 400 (16)	300 (12) long
450 through 600 (18 through 24)	350 (14) long

- B. Warm or hot pipe supports: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 149 degrees C [300 degrees F]), cellular glass or calcium silicate. Insulation at

supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m<sup>3</sup> (3.0 pcf).

C. NOT USED

#### **2.12 ADHESIVE, MASTIC, CEMENT**

- A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.
- B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.
- C. Mil. Spec. MIL-A-24179, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.
- D. Mil. Spec. MIL-C-19565, Type I: Protective finish for outdoor use.
- E. Mil. Spec. MIL-C-19565, Type I or Type II: Vapor barrier compound for indoor use.
- F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.
- G. Other: Insulation manufacturers' published recommendations.

#### **2.13 MECHANICAL FASTENERS**

- A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel-coated or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.
- B. Staples: Outward clinching monel.
- C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.
- D. Bands: 13 mm (0.5 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

#### **2.14 REINFORCEMENT AND FINISHES**

- A. Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).
- B. Glass fiber fitting tape: Mil. Spec MIL-C-20079, Type II, Class 1.
- C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.
- D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.
- E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.

F. PVC fitting cover: Fed. Spec L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Below 4 degrees C (40 degrees F) and above 121 degrees C (250 degrees F). Provide double layer insert. Provide color matching vapor barrier pressure sensitive tape.

#### **2.15 FIRESTOPPING MATERIAL**

Other than pipe and duct insulation, refer to Section 07 84 00  
FIRESTOPPING.

#### **2.16 FLAME AND SMOKE**

Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

### **PART 3 - EXECUTION**

#### **3.1 GENERAL REQUIREMENTS**

- A. Required pressure tests of duct and piping joints and connections shall be completed and the work approved by the COR for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.
- B. Except for specific exceptions, insulate entire specified equipment, piping (pipe, fittings, valves, accessories), and duct systems. Insulate each pipe and duct individually. Do not use scrap pieces of insulation where a full length section will fit.
- C. NOT USED
- D. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor retarder over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).
- E. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.

- F. Construct insulation on parts of equipment such as chilled water pumps and heads of chillers, convertors and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.
- G. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.
- H. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.
- I. HVAC work not to be insulated:
  - 1. Equipment: Steam condensate pumps.
  - 2. Threaded and flanged valves
  - 3. Unions
  - 4. Flexible connectors
- J. NOT USED
- K. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.
- L. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/ fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow/ fitting. Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.
- M. Firestop Pipe and Duct insulation:
  - 1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed as defines in FIRESTOPPING.
  - 2. Pipe and duct penetrations requiring fire stop insulation including, but not limited to the following:
    - a. Pipe risers through floors
    - b. Pipe or duct chase walls and floors

- c. Smoke partitions
  - d. Fire partitions
- N. Freeze protection of above grade outdoor piping (over heat tracing tape): 26 mm (10 inch) thick insulation, for all pipe sizes 75 mm(3 inches) and smaller and 25 mm(1inch) thick insulation for larger pipes. Provide metal jackets for all pipes. Provide for cold water make-up to cooling towers and condenser water piping and chilled water piping as described in Section 23 21 13, HYDRONIC PIPING (electrical heat tracing systems).
- O. Provide vapor barrier jackets over insulation as follows:
- 1. All piping and ductwork exposed to outdoor weather.
- P. Provide metal jackets over insulation as follows:
- 1. All piping exposed to outdoor weather.
  - 2. Piping exposed in building, within 1800 mm (6 feet) of the floor, that connects to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.
  - 3. A 50 mm (2 inch) overlap is required at longitudinal and circumferential joints.

### **3.2 INSULATION INSTALLATION**

- A. Mineral Fiber Board:
- 1. Faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.
  - 2. Plain board:
    - a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.
    - b. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating

- and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowel led to a smooth finish.
- c. For cold equipment: Apply meshed glass fabric in a tack coat 1.5 to 1.7 square meter per liter (60 to 70 square feet per gallon) of vapor mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.
  - d. Chilled water pumps: Insulate with removable and replaceable 1 mm thick (20 gage) aluminum or galvanized steel covers lined with insulation. Seal closure joints/flanges of covers with gasket material. Fill void space in enclosure with flexible mineral fiber insulation.
3. Exposed, unlined ductwork and equipment in unfinished areas, mechanical and electrical equipment rooms and attics, interstitial spaces and duct work exposed to outdoor weather:
- a. 40 mm (1-1/2 inch) thick insulation faced with ASJ (white all service jacket): Supply air duct.
  - b. 40 mm (1-1/2 inch) thick insulation faced with ASJ: Return air duct
  - c. Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a reinforcing membrane and two coats of vapor barrier mastic or multi-layer vapor barrier with a maximum water vapor permeability of 0.001 perms.
4. Hot equipment: 40 mm (1-1/2 inch) thick insulation faced with ASJ.
- a. Convertors, air separators, steam condensate pump receivers.
  - b. Reheat coil casing and separation chambers on steam humidifiers located above ceilings.
  - c. Domestic water heaters and hot water storage tanks (not factory insulated).
  - d. Booster water heaters for dietetics dish and pot washers and for washdown grease-extracting hoods.
5. Cold equipment: 40 mm (1-1/2inch) thick insulation faced with ASJ.
- a. Chilled water pumps, water filter, chemical feeder pot or tank.
  - b. NOT USED

B. Flexible Mineral Fiber Blanket:

1. Adhere insulation to metal with 75 mm (3 inch) wide strips of insulation bonding adhesive at 200 mm (8 inches) on center all around duct. Additionally secure insulation to bottom of ducts exceeding 600 mm (24 inches) in width with pins welded or adhered on 450 mm (18 inch) centers. Secure washers on pins. Butt insulation edges and seal joints with laps and butt strips. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations with mastic. Sagging duct insulation will not be acceptable. Install firestop duct insulation where required.
2. Supply air ductwork to be insulated includes main and branch ducts from AHU discharge to room supply outlets, and the bodies of ceiling outlets to prevent condensation. Insulate sound attenuator units, coil casings and damper frames. To prevent condensation insulate trapeze type supports and angle iron hangers for flat oval ducts that are in direct contact with metal duct.
3. Concealed supply air ductwork.
  - a. Above ceilings at a roof level, in attics, and duct work exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with FSK.
  - b. Above ceilings for other than roof level: 40 mm (1 ½ inch) thick insulation faced with FSK.

C. Molded Mineral Fiber Pipe and Tubing Covering:

1. Fit insulation to pipe or duct, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
2. Contractor's options for fitting, flange and valve insulation:
  - a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 16 degrees C (61 degrees F) or more.
  - b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures

below 4 degrees C (40 degrees F), or above 121 degrees C (250 degrees F). Secure first layer of insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.

c. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 16 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.

d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).

3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.

D. Rigid Cellular Phenolic Foam:

1. Rigid closed cell phenolic insulation may be provided for piping, ductwork and equipment for temperatures up to 121 degrees C (250 degrees F).

2. Note the NFPA 90A burning characteristics requirements of 25/50 in paragraph 1.3.B

3. Provide secure attachment facilities such as welding pins.

4. Apply insulation with joints tightly drawn together

5. Apply adhesives, coverings, neatly finished at fittings, and valves.

6. Final installation shall be smooth, tight, neatly finished at all edges.

7. Minimum thickness in millimeters (inches) specified in the schedule at the end of this section.

8. Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a multi-layer vapor barrier with a maximum water vapor permeance of 0.00 perms.

9. Condensation control insulation: Minimum 25 mm (1.0 inch) thick for all pipe sizes.

a. HVAC: Cooling coil condensation piping to waste piping fixture or drain inlet. Omit insulation on plastic piping in mechanical rooms.

E. Cellular Glass Insulation:

1. Pipe and tubing, covering nominal thickness in millimeters and inches as specified in the schedule at the end of this section.



2. Underground Piping Other than or in lieu of that Specified in Section 23 21 13, HYDRONIC PIPING: Type II, factory jacketed with a 3 mm laminate jacketing consisting of 3000 mm x 3000 mm (10 ft x 10 ft) asphalt impregnated glass fabric, bituminous mastic and outside protective plastic film.
    - a. 75 mm (3 inches) thick for hot water piping.
    - b. As scheduled at the end of this section for chilled water piping.
    - c. Underground piping: Apply insulation with joints tightly butted. Seal longitudinal self-sealing lap. Use field fabricated or factory made fittings. Seal butt joints and fitting with jacketing as recommended by the insulation manufacturer. Use 100 mm (4 inch) wide strips to seal butt joints.
    - d. Provide expansion chambers for pipe loops, anchors and wall penetrations as recommended by the insulation manufacturer.
    - e. Underground insulation shall be inspected and approved by the COR as follows:
      - 1) Insulation in place before coating.
      - 2) After coating.
    - f. Sand bed and backfill: Minimum 75 mm (3 inches) all around insulated pipe or tank, applied after coating has dried.
  3. Cold equipment: 50 mm (2 inch) thick insulation faced with ASJ for chilled water pumps, water filters, chemical feeder pots or tanks, expansion tanks, air separators and air purgers.
  4. NOT USED
- F. Polyisocyanurate Closed-Cell Rigid Insulation:
1. Polyisocyanurate closed-cell rigid insulation (PIR) may be provided for exterior piping, equipment and ductwork for temperature up to 149 degree C (300 degree F).
  2. Install insulation, vapor barrier and jacketing per manufacturer's recommendations. Particular attention should be paid to recommendations for joint staggering, adhesive application, external hanger design, expansion/contraction joint design and spacing and vapor barrier integrity.
  3. Install insulation with all joints tightly butted (except expansion joints in hot applications).

4. If insulation thickness exceeds 63 mm (2.5 inches), install as a double layer system with longitudinal (lap) and butt joint staggering as recommended by manufacturer.
  5. For cold applications, vapor barrier shall be installed in a continuous manner. No staples, rivets, screws or any other attachment device capable of penetrating the vapor barrier shall be used to attach the vapor barrier or jacketing. No wire ties capable of penetrating the vapor barrier shall be used to hold the insulation in place. Banding shall be used to attach PVC or metal jacketing.
  6. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/ fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow/ fitting. Use of polyurethane spray-foam to fill PVC elbow jacket is prohibited on cold applications.
  7. For cold applications, the vapor barrier on elbows/fittings shall be either mastic-fabric-mastic or 2 mil thick PVDC vapor barrier adhesive tape.
  8. All PVC and metal jacketing shall be installed so as to naturally shed water. Joints shall point down and shall be sealed with either adhesive or caulking (except for periodic slip joints).
  9. Underground piping: Follow instructions for above ground piping but the vapor retarder jacketing shall be 6 mil thick PVDC or minimum 30 mil thick rubberized bituminous membrane. Sand bed and backfill shall be a minimum of 150 mm (6 inches) all around insulated pipe.
  10. Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a multi-layer vapor barrier with a water vapor permeance of 0.00 perms.
  11. Note the NFPA 90A burning characteristic requirements of 25/50 in paragraph 1.3B. Refer to paragraph 3.1 for items not to be insulated.
  12. Minimum thickness in millimeter (inches) specified in the schedule at the end of this section.
- G. Flexible Elastomeric Cellular Thermal Insulation:
1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats

- of weather resistant finish as recommended by the insulation manufacturer.
2. Pipe and tubing insulation:
    - a. Use proper size material. Do not stretch or strain insulation.
    - b. To avoid undue compression of insulation, provide cork stoppers or wood inserts at supports as recommended by the insulation manufacturer. Insulation shields are specified under Section 23 05 11, COMMON WORK RESULTS FOR HVAC,
    - c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Make changes from mineral fiber insulation in a straight run of pipe, not at a fitting. Seal joint with tape.
  3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
  4. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section.
  5. Minimum 20 mm (0.75 inch) thick insulation for pneumatic control lines for a minimum distance of 6 m (20 feet) from discharge side of the refrigerated dryer.
  6. Use Class S (Sheet), 20 mm (3/4 inch) thick for the following:
    - a. Chilled water pumps
    - b. Bottom and sides of metal basins for winterized cooling towers (where basin water is heated).
    - c. Chillers, insulate any cold chiller surfaces subject to condensation which has not been factory insulated.
    - d. Piping inside refrigerators and freezers: Provide heat tape under insulation.
  7. Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a multi-layer vapor barrier with a water vapor permeance of 0.00 perms.

H. NOT USED

I. Calcium Silicate:

1. Minimum thickness in millimeter (inches) specified in the schedule at the end of this section for piping other than in boiler plant.

**3.3 PIPE INSULATION SCHEDULE**

Provide insulation for piping systems as scheduled below:

<b>Insulation Thickness Millimeters (Inches)</b>					
		Nominal Pipe Size Millimeters (Inches)			
Operating Temperature Range/Service	Insulation Material	Less than 25 (1)	25 - 32 (1 - 1¼)	38 - 75 (1½ - 3)	100 (4) and Above
122-177 degrees C (251-350 degrees F) (HPS, MPS)	Mineral Fiber (Above ground piping only)	75 (3)	100 (4)	113 (4.5)	113 (4.5)
93-260 degrees C (200-500 degrees F) (HPS, HPR)	Calcium Silicate	100 (4)	125 (5)	150 (6)	150 (6)
100-121 degrees C (212-250 degrees F) (HPR, MPR, LPS, vent piping from PRV Safety Valves, Condensate receivers and flash tanks)	Mineral Fiber (Above ground piping only)	62 (2.5)	62 (2.5)	75 (3.0)	75 (3.0)
100-121 degrees C (212-250 degrees F) (HPR, MPR, LPS, vent piping from PRV Safety Valves, Condensate receivers and flash tanks)	Rigid Cellular Phenolic Foam	50 (2.0)	50 (2.0)	75 (3.0)	75 (3.0)
38-94 degrees C (100-200 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-99 degrees C (100-211 degrees F) (LPR, PC, HWH, HWHR,	Rigid Cellular Phenolic Foam	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)

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GH and GHR)					
39-99 degrees C (100-211 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Polyiso- cyanurate Closed-Cell Rigid (Exterior Locations only)	38 (1.5)	38 (1.5)	----	----
38-94 degrees C (100-200 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	----	----
4-16 degrees C (40-60 degrees F) (CH, CHR, GC, GCR and RS for DX refrigeration)	Rigid Cellular Phenolic Foam	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)
4-16 degrees C (40-60 degrees F) (CH and CHR within chiller room and pipe chase and underground)	Cellular Glass Closed- Cell	50 (2.0)	50 (2.0)	75 (3.0)	75 (3.0)
4-16 degrees C (40-60 degrees F) (CH, CHR, GC, GCR and RS for DX refrigeration)	Cellular Glass Closed- Cell	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)
4-16 degrees C (40-60 degrees F) (CH, CHR, GC and GCR (where underground)	Polyiso- cyanurate Closed-Cell Rigid	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
4-16 degrees C (40-60 degrees F) (CH, CHR, GC, GCR and RS for DX refrigeration)	Polyiso- cyanurate Closed-Cell Rigid (Exterior Locations only)	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)
(40-60 degrees F) (CH, CHR, GC, GCR	Flexible Elastomeric	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)

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and RS for DX refrigeration)	Cellular Thermal (Above ground piping only)				
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- - - E N D - - -

**SECTION 23 09 23**  
**DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The control system(s) shall be as indicated on the project documents, point list, drawings and described in these specifications. This scope of work shall include a complete and working system including all engineering, programming, controls and installation materials, installation labor, commissioning and start-up, training, final project documentation and warranty.
- B. Engineering Control Center (ECC) shall include:
  - 1. Operator Workstation Web-Browser User Interface (UI).
  - 2. Ethernet, IP Supervisory Network.
  - 3. Portable Laptop servicing device with software.
  - 4. Graphic Operational Interface.
  - 5. Software Configuration Tools (SCT).
  - 6. Scheduling and Alarm Management software.
  - 7. Local LonWorks FTT-10 or 1250 networks.
  - 8. Network Area Controllers (NAC).
  - 9. Data and File Server (DFS).
  - 10. Unitary Control Units (UCU).
  - 11. LonMark Compliant Application Controllers and field devices.
  - 12. Connected I/O devices.
  - 13. Third party system Data Integration.
- C. The Controls Contractor's work shall include all labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, Project specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, Warranty, specified services and items required by the Contract for the complete and fully functional Controls Systems.
- D. Following control devices and systems shall be used to provide the functional requirements of HVAC equipment and systems.
  - 1. Direct Digital Control (DDC) of HVAC equipment and systems with electric or electronic positioning of valves and dampers.

2. Terminal units including VAV Boxes, Fan Powered Boxes, Unit Heaters, Cabinet Unit Heaters, Fan Coil Units, Base Board Heaters, Secondary Humidifiers and similar units for control of room environment conditions may be equipped with integral controls furnished and installed by the equipment manufacturer or field mounted. Refer to equipment specifications and as indicated in project documents.
- E. Connect the new work to the existing ECC system or operator workstation manufactured by AUTOMATED LOGIC. The existing CPU/Monitor, printer, and other peripherals may be used to form a single operator workstation. New system including interface to existing systems and equipment shall operate and function as one complete system including one database of control point objects and global control logic capabilities. Facility operators shall have complete operations and control capability over all systems, new and existing including; monitoring, trending, graphing, scheduling, alarm management, global point sharing, global strategy deployment, graphical operations interface and custom reporting as specified. Modify the existing ECC, if necessary, to accommodate the additional control points.
- F. The control subcontractor shall supply as required, all necessary hardware equipment and software packages to interface between any existing and new system Network Area Controllers (NAC) as part of this contract. Number of area controllers required is dependent on the type and quantity of devices, hardware and software points provided. Network area controllers are same as remote controller units (RCU).
- G. The control systems shall be designed such that each mechanical system shall operate under stand-alone mode. Temperature Controls contractor shall provide controllers for each mechanical system. In the event of a network communication failure, or the loss of any other controller, the control system shall continue to operate independently. Failure of the ECC shall have no effect on the field controllers, including those involved with global strategies.
- H. The Top End of the NAC shall communicate using American Society of Heating and Refrigerating Engineers/American National Standards Institute (ASHRAE/ANSI) Standard 135(BACnet) protocol. The NAC shall reside on the BACnet/IP Ethernet (ISO 8802-3) local area network, and provide information via standard BACnet object types and application services. The Bottom End of the NAC, the unit level controllers and all



other field devices shall reside on the LonTalk FTT-10a network, and provide data using LonMark standard network variable types and configuration properties.

- I. The intent of this specification is to provide a peer-to peer networked, stand-alone, distributed control system. The ECC requires the incorporation of LonWorks Technologies using Free Topology Transceivers (FTT-10), and specific conformance to the LONMARK Interoperability Association's v3.0 Physical and logical Layer guidelines in all (NAC) Network Area Controllers, Remote Control Unit controllers, unitary terminal unit controllers and other LonMark compliant field devices. The minimum Baud rate shall be 78,000 Baud for FTT-10 and 1,250,000 Baud for FTT-1250.
  1. LonTalk communications protocol will be used on the communication network between RCU controllers and LonWorks controllers and devices to assure interoperability between all devices within the network.
  2. The ECC shall provide communication to all LonTalk data variables as defined in input/output point schedule and as required to accomplish sequence of operation as specified.
  3. Power wiring shall not be run in conduit with communications trunk wiring or signal or control wiring operating at 100 volts or less.
- J. The control system shall accommodate 5 users simultaneously, and the access to the system should be limited only by operator password.

## 1.2 RELATED WORK

- A. NOT USED
- B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- C. NOT USED
- D. Section 23 21 13, HYDRONIC PIPING.
- E. Section 23 36 00, AIR TERMINAL UNITS.
- F. Section 23 31 00, HVAC DUCTS AND CASINGS.
- G. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
- H. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- I. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.
- J. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW)
- K. Section 26 27 26, WIRING DEVICES.

### 1.3 DEFINITION

- A. Algorithm: A logical procedure for solving a recurrent mathematical problem; A prescribed set of well-defined rules or processes for the solution of a problem in a finite number of steps.
- B. ACU: Auxiliary Control Unit (ACU) used for controls of air handling units, reports to RCU.
- C. Analog: A continuously varying signal value (e.g., temperature, current, velocity etc).
- D. BACnet: Building Automation Control Network Protocol, ASHRAE Standard 135.
- E. Baud: It is a signal change in a communication link. One signal change can represent one or more bits of information depending on type of transmission scheme. Simple peripheral communication is normally one bit per Baud. (e.g., Baud rate = 78,000 Baud/sec is 78,000 bits/sec, if one signal change = 1 bit).
- F. Binary: A two-state system where a high signal level represents an "ON" condition and an "OFF" condition is represented by a low signal level.
- G. BMP or bmp: Suffix, computerized image file, used after the period in a DOS-based computer file to show that the file is an image stored as a series of pixels.
- H. Bus Topology: A network topology that physically interconnects workstations and network devices in parallel on a network segment.
- I. Control Unit (CU): Generic term for any controlling unit, stand-alone, microprocessor based, digital controller residing on secondary LAN or Primary LAN, used for local controls or global controls. In this specification, there are three types of control units are used; Unitary Control Unit (UCU), Auxiliary Control Unit (ACU), and Remote Control Unit (RCU).
- J. Deadband: A temperature range over which no heating or cooling is supplied, i.e., 22-25 degrees C (72-78 degrees F), as opposed to a single point change over or overlap).
- K. Diagnostic Program: A software test program, which is used to detect and report system or peripheral malfunctions and failures. Generally, this system is performed at the initial startup of the system.
- L. Direct Digital Control (DDC): Microprocessor based control including Analog/Digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and

processed by a microprocessor, and digital control signals are generated based on control algorithms and transmitted to field devices in order to achieve a set of predefined conditions.

- M. Distributed Control System: A system in which the processing of system data is decentralized and control decisions can and are made at the subsystem level. System operational programs and information are provided to the remote subsystems and status is reported back to the Engineering Control Center. Upon the loss of communication with the Engineering Control center, the subsystems shall be capable of operating in a stand-alone mode using the last best available data.
- N. Download: The electronic transfer of programs and data files from a central computer or operation workstation with secondary memory devices to remote computers in a network (distributed) system.
- O. DXF: An AutoCAD 2-D graphics file format. Many CAD systems import and export the DXF format for graphics interchange.
- P. Electrical Control: A control circuit that operates on line or low voltage and uses a mechanical means, such as a temperature sensitive bimetal or bellows, to perform control functions, such as actuating a switch or positioning a potentiometer.
- Q. Electronic Control: A control circuit that operates on low voltage and uses a solid-state components to amplify input signals and perform control functions, such as operating a relay or providing an output signal to position an actuator.
- R. Engineering Control Center (ECC): The centralized control point for the intelligent control network. The ECC comprises of personal computer and connected devices to form a single workstation.
- S. Ethernet: A trademark for a system for exchanging messages between computers on a local area network using coaxial, fiber optic, or twisted-pair cables.
- T. Firmware: Firmware is software programmed into read only memory (ROM) chips. Software may not be changed without physically altering the chip.
- U. FTT-10: Echelon Transmitter-Free Topology Transceiver.
- V. GIF: Abbreviation of Graphic interchange format.
- W. Graphic Program (GP): Program used to produce images of air handler systems, fans, chillers, pumps, and building spaces. These images can be animated and/or color-coded to indicate operation of the equipment.

- X. Graphic Sequence of Operation: It is a graphical representation of the sequence of operation, showing all inputs and output logical blocks.
- Y. I/O Unit: The section of a digital control system through which information is received and transmitted. I/O refers to analog input (AI, digital input (DI), analog output (AO) and digital output (DO). Analog signals are continuous and represent temperature, pressure, flow rate etc, whereas digital signals convert electronic signals to digital pulses (values), represent motor status, filter status, on-off equipment etc.
- Z. I/P: Internet Protocol-global network, connecting workstations and other host computers, servers etc. to share the information.
- AA. JPEG: A standardized image compression mechanism stands for Joint Photographic Experts Group, the original name of the committee that wrote the standard.
- BB. Local Area Network (LAN): A communication bus that interconnects operator workstation and digital controllers for peer-to-peer communications, sharing resources and exchanging information.
- CC. LonMark: An association comprising of suppliers and installers of LonTalk products. The Association provides guidelines for the implementation of the LonTalk protocol to ensure interoperability through Standard implementation.
- DD. LonTalk: An open standard protocol developed by the Echelon Corporation that uses a "Neuron Chip" for communication.
- EE. LonWorks: Network technology developed by the Echelon Corporation.
- FF. Network: A set of computers or other digital devices communicating with each other over a medium such as wire, coax, fiber optics cable etc.
- GG. Network Area Controller: Digital controller, supports a family of auxiliary control units and unitary control units, and communicates with peer-to-peer network for transmission of global data.
- HH. Network Repeater: A device that receives data packet from one network and rebroadcasts to another network. No routing information is added to the protocol.
- II. MS/TP: Master-slave/token-passing.
- JJ. Operating system (OS): Software, which controls the execution of computer application programs.

- KK. PCX: File type for an image file. When photographs are scanned onto a personal computer they can be saved as PCX files and viewed or changed by a special application program as Photo Shop.
- LL. Peripheral: Different components that make the control system function as one unit. Peripherals include monitor, printer, and I/O unit.
- MM. Peer-to-Peer: A networking architecture that treats all network stations as equal partners.
- NN. PICS: Protocol Implementation Conformance Statement.
- OO. UCU: Unitary Control Unit, digital controller, dedicated to a specific piece of equipment, such as VAV boxes, chillers, fan coil units, heat exchangers etc.

#### **1.4 QUALITY ASSURANCE**

##### **A. Criteria:**

1. The Controls and Instrumentation System Contractor shall be a primary equipment manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated Facility Management Systems of similar size, scope and complexity to the EEC specified in this Contract. Distributors, manufacturer's representatives and wholesalers will not be acceptable.
2. Single Source Responsibility of subcontractor: The Contractor shall obtain hardware and software supplied under this Section and delegates the responsibility to a single source controls installation subcontractor. The controls subcontractor shall be responsible for the complete design, installation, and commissioning of the system. The controls subcontractor shall be in the business of design, installation and service of such building automation control systems similar in size and complexity.
3. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.
4. The controls subcontractor shall provide a list of no less than five similar projects which have building control systems as specified in this Section. These projects must be on-line and functional such

that the Department of Veterans Affairs (VA) representative would observe the control systems in full operation.

5. The controls subcontractor shall have (minimum of three years) experience in design and installation of building automation systems similar in performance to those specified in this Section. Provide evidence of experience by submitting resumes of the project manager, the local branch manager, project engineer, the application engineering staff, and the electronic technicians who would be involved with the supervision, the engineering, and the installation of the control systems. Training and experience of these personnel shall not be less than three years. Failure to disclose this information will be a ground for disqualification of the supplier.
6. The controls subcontractor shall have in-place facility within 50 miles with technical staff, spare parts inventory for the next five (5) years, and necessary test and diagnostic equipment to support the control systems.
7. Provide a competent and experienced Project Manager employed by the Controls Contractor. The Project Manager shall be supported as necessary by other Contractor employees in order to provide professional engineering, technical and management service for the work. The Project Manager shall attend scheduled Project Meetings as required and shall be empowered to make technical, scheduling and related decisions on behalf of the Controls Contractor.

B. Codes and Standards:

1. All work shall conform to the applicable Codes and Standards.
2. Electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference, and be so labeled.
3. Peer-to-peer controllers, unitary controllers shall conform to the requirements of UL 916, Category PAZX.

**1.5 PERFORMANCE**

A. The system shall conform to the following:

1. Graphic Display: The system shall display up to 4 graphics on a single screen with a minimum of (20) dynamic points per graphic. All current data shall be displayed within (10) seconds of the request.

2. **Graphic Refresh:** The system shall update all dynamic points with current data within (10) seconds. Data refresh shall be automatic, without operator intervention.
3. **Object Command:** The maximum time between the command of a binary object by the operator and the reaction by the device shall be (10) seconds. Analog objects shall start to adjust within (3) seconds.
4. **Object Scan:** All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or work-station will be current, within the prior (10) seconds.
5. **Alarm Response Time:** The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed (10) seconds.
6. **Program Execution Frequency:** Custom and standard applications shall be capable of running as often as once every (5) seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
7. **Performance:** Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every five (5) seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
8. **Multiple Alarm Annunciations:** All workstations on the network shall receive alarms within (5) seconds of each other.
9. **Reporting Accuracy:** Listed below are minimum acceptable reporting accuracies for all values reported by the specified system:

<b>Measured Variable</b>	<b>Reported Accuracy</b>
Space temperature	±0.5 degrees C (±1 degrees F)
Ducted air temperature	±1.0 degrees C [±2 degrees F]
Outdoor air temperature	±1.0 degrees C [±2 degrees F]
Water temperature	±0.5 degrees C [±1 degrees F]
Relative humidity	±2 percent RH
Water flow	±5 percent of full scale
Air flow (terminal)	±10 percent of reading
Air flow (measuring stations)	±5 percent of reading

Air pressure (ducts)	±25 Pa [±0.1 "W.G.]
Air pressure (space)	±3 Pa [±0.001 "W.G.]
Water pressure	±2 percent of full scale *Note 1
Electrical Power	5 percent of reading

Note 1: for both absolute and differential pressure

**1.6 WARRANTY**

- A. Labor and materials for control systems shall be warranted for a period as specified under Warranty in FAR clause 52.246-21.
- B. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no cost or reduction in service to the owner. The system includes all computer equipment, transmission equipment, and all sensors and control devices.
- C. Controls and Instrumentation subcontractor shall be responsible for temporary operations and maintenance of the control systems during the construction period until final commissioning, training of facility operators and acceptance of the project by VA.

**1.7 SUBMITTALS**

- A. Submit shop drawings in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's literature and data for all components including the following:
  - 1. A wiring diagram for each type of input device and output device including DDC controllers, modems, repeaters, etc. Diagram shall show how the device is wired and powered, showing typical connections at the digital controllers and each power supply, as well as the device itself. Show for all field connected devices, including but not limited to, control relays, motor starters, electric or electronic actuators, and temperature pressure, flow and humidity sensors and transmitters.
  - 2. A diagram of each terminal strip, including digital controller terminal strips, terminal strip location, termination numbers and the associated point names.
  - 3. Control dampers and control valves schedule, including the size and pressure drop.
  - 4. Installation instructions for smoke dampers and combination smoke/fire dampers, if furnished.



5. Control air-supply components, and computations for sizing compressors, receivers and main air-piping, if pneumatic controls are furnished.
  6. Catalog cut sheets of all equipment used. This includes, but is not limited to DDC controllers, panels, peripherals, airflow measuring stations and associated components, and auxiliary control devices such as sensors, actuators, and control dampers. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted. Each submitted piece of literature and drawings should clearly reference the specification and/or drawings that it supposed to represent.
  7. Sequence of operations for each HVAC system and the associated control diagrams. Equipment and control labels shall correspond to those shown on the drawings.
  8. Color prints of proposed graphics with a list of points for display.
  9. Furnish PICS for each BACNET compliant device.
- C. Product Certificates: Compliance with Article, QUALITY ASSURANCE.
- D. As Built Control Drawings:
1. Furnish three (3) copies of as-built drawings for each control system. The documents shall be submitted for approval prior to final completion.
  2. Furnish one (1) stick set of applicable control system prints for each mechanical system for wall mounting. The documents shall be submitted for approval prior to final completion.
  3. Furnish one (1) CD-ROM in CAD DWG and/or .DXF format for the drawings noted in subparagraphs above.
- E. Operation and Maintenance (O/M) Manuals):
1. Submit in accordance with Article, INSTRUCTIONS, in Specification Section 01 00 00, GENERAL REQUIREMENTS.
  2. Include the following documentation:
    - a. General description and specifications for all components, including logging on/off, alarm handling, producing trend reports, overriding computer control, and changing set points and other variables.

- b. Detailed illustrations of all the control systems specified for ease of maintenance and repair/replacement procedures, and complete calibration procedures.
  - c. One copy of the final version of all software provided including operating systems, programming language, operator workstation software, and graphics software.
  - d. Complete troubleshooting procedures and guidelines for all systems.
  - e. Complete operating instructions for all systems.
  - f. Recommended preventive maintenance procedures for all system components including a schedule of tasks for inspection, cleaning and calibration. Provide a list of recommended spare parts needed to minimize downtime.
  - g. Licenses, guaranty, and other pertaining documents for all equipment and systems.
  - h. Training Manuals: Submit the course outline and training material to the Owner for approval three (3) weeks prior to the training to VA facility personnel. These persons will be responsible for maintaining and the operation of the control systems, including programming. The Owner reserves the right to modify any or all of the course outline and training material.
- F. Submit Performance Report to COTR prior to final inspection.

#### **1.8 INSTRUCTIONS**

- A. Instructions to VA operations personnel: Perform in accordance with Article, INSTRUCTIONS, in Specification Section 01 00 00, GENERAL REQUIREMENTS, and as noted below.
- 1. First Phase: Formal instructions to the VA facilities personnel for a total of 16 hours, conducted sometime between the completed installation and prior to the performance test period of the control system, at a time mutually agreeable to the Contractor and the VA.
  - 2. Second Phase: This phase of training shall comprise of on the job training during start-up, checkout period, and performance test period. VA facilities personnel will work with the Contractor's installation and test personnel on a daily basis during start-up and checkout period. During the performance test period, controls subcontractor will provide 8 hours of instructions to the VA facilities personnel.

3. The O/M Manuals shall contain approved submittals as outlined in Article 1.7, SUBMITTALS. The Controls subcontractor will review the manual contents with VA facilities personnel during second phase of training.
4. Training by independent or franchised dealers who are not direct employees of the controls supplier will not be acceptable.

**1.9 PROJECT CONDITIONS (ENVIRONMENTAL CONDITIONS OF OPERATION)**

- A. The ECC and peripheral devices and system support equipment shall be designed to operate in ambient condition of 20 to 35 degrees C (65 to 90 degrees F) at a relative humidity of 20 to 80 percent non-condensing.
- B. The CUs and associated equipment used in controlled environment shall be mounted in NEMA 1 enclosures for operation at 0 to 50 degrees C (32 to 122 degrees F) at a relative humidity of 10 to 90 percent non-condensing.
- C. The CUs used outdoors shall be mounted in NEMA 4 waterproof enclosures, and shall be rated for operation at -40 to 65 degrees C (-40 to 150 degrees F).
- D. All electronic equipment shall operate properly with power fluctuations of plus 10 percent to minus 15 percent of nominal supply voltage.
- E. Sensors and controlling devices shall be designed to operate in the environment, which they are sensing or controlling.

**1.10 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):  
Standard 135-04.....BACNET Building Automation and Control Networks
- C. American Society of Mechanical Engineers (ASME):  
B16.18-01.....Cast Copper Alloy Solder Joint Pressure Fittings.  
B16.22-01.....Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.  
BPVC-CC-N-04.....Boiler and Pressure Vessel Code
- D. American Society of Testing Materials (ASTM):  
B32-04.....Standard Specification for Solder Metal

- B88-03.....Standard Specifications for Seamless Copper  
Water Tube
- B88M-05.....Standard Specification for Seamless Copper  
Water Tube (Metric)
- B280-03.....Standard Specification for Seamless Copper Tube  
for Air-Conditioning and Refrigeration Field  
Service
- D2737-03.....Standard Specification for Polyethylene (PE)  
Plastic Tubing
- E. Federal Communication Commission (FCC):  
Rules and Regulations Title 47 Chapter 1-2001 Part 15..Radio Frequency  
Devices.
- F. Institute of Electrical and Electronic Engineers (IEEE):  
802.3-05.....Information Technology-Telecommunications and  
Information Exchange between Systems-Local and  
Metropolitan Area Networks- Specific  
Requirements-Part 3: Carrier Sense Multiple  
Access with Collision Detection (CSMA/CD)  
Access method and Physical Layer Specifications
- G. Instrument Society of America (ISA):  
7.0.01-1996.....Quality Standard for Instrument Air
- H. National Fire Protection Association (NFPA):  
70-05.....National Electric Code  
90A-02.....Standard for Installation of Air-Conditioning  
and Ventilation Systems
- I. Underwriter Laboratories Inc (UL):  
94-06.....Tests for Flammability of Plastic Materials for  
Parts and Devices and Appliances  
294-05.....Access Control System Units  
486A/486B-04-.....Wire Connectors  
555S-03.....Standard for Smoke Dampers  
916-Rev 2-04.....Energy Management Equipment  
1076-05.....Proprietary Burglar Alarm Units and Systems

**PART 2 - PRODUCTS**

**2.1 CONTROLS SYSTEM ARCHITECTURE**

A. General

1. The Controls Systems shall consist of multiple Nodes and associated equipment connected by industry standard digital and communication network arrangements.
  2. The Operator Workstations, Servers and principal network computer equipment shall be standard products of recognized major manufacturers available through normal PC and computer vendor channels - not "Clones" assembled by a third-party subcontractor.
  3. Provide licenses for all software residing on and used by the Controls Systems and transfer these licenses to the Owner prior to completion.
  4. The networks shall, at minimum, comprise, as necessary, the following:
    - a. Operator Workstations - fixed and portable as required by the Specifications.
    - b. Network computer processing, data storage and communication equipment including Servers and digital data processors.
    - c. Routers, bridges, switches, hubs, modems, interfaces and the like communication equipment.
    - d. Active processing network area controllers connected to programmable field panels and controllers together with their power supplies and associated equipment.
    - e. Addressable elements, sensors, transducers and end devices.
    - f. Third-party equipment interfaces as required by the Contract Documents.
    - g. Other components required for a complete and working Control Systems as specified.
- B. The Specifications for the individual elements and component subsystems shall be minimum requirements and shall be augmented as necessary by the Contractor to achieve both compliance with all applicable codes, standards and to meet all requirements of the Contract Documents.
- C. Network Architecture
1. The Controls Systems Application network shall utilize an open architecture capable of each and all of the following:
    - a. Utilizing standard Ethernet communications and operate at a minimum speed of 10/100 Mb/sec.
    - b. Connecting via BACNET with ANSI/ASHRAE Standard 135.

- c. LonMark as per ANSI/EIA 709 (LonWorks) to LonMark FTT-10 transceivers.
  2. The networks shall utilize only copper and optical fiber communication media as appropriate and shall comply with applicable codes, ordinances and regulations.
  3. All necessary telephone lines, ISDN lines and internet Service Provider services and connections will be provided by the owner.
- D. Third Party Interfaces:
1. The Controls Systems shall include necessary hardware, equipment and software to allow data communications between the Controls Systems and building systems supplied by other trades.
  2. The other manufacturers and contractors supplying other associated systems and equipment will provide their necessary hardware, software and start-up at their cost and will cooperate fully with the Controls Contractor in a timely manner and at their cost to ensure complete functional integration.
- E. Servers:
1. Provide Controls Systems Application Server(s) to archive historical data including trends, alarm and event histories and transaction logs.
  2. Equip these Server(s) with the same software Tool Set that is located in the Network Area Controllers for system configuration and custom logic definition and color graphic configuration.
  3. Access to all information on the Controls Systems Server(s) shall be through the same browser Operator Interface functionality used to access individual nodes. When logged onto a Server the Operator will be able to also interact with any other NAC on the Controls As required for the functional operation of the Controls Systems, the Controls Contractor shall provide all necessary digital processor programmable Server(s). These Server(s) shall be utilized for Controls Systems Application configuration, for archiving, reporting and trending of data, for Operator transaction archiving and reporting, for network information management, for alarm annunciation, for Operator Interface tasks, for Controls Application management and the like. These Server(s) shall utilize IT industry standard data base platforms such as Microsoft SQL Server and Microsoft Data Engine (MSDE) or approved equal.

## 2.2 DIRECT DIGITAL CONTROLLERS

- A. Auxiliary Control Units (ACUs) shall be stand-alone, multi-tasking, multi-user, real time digital processor complete with all hardware, software and communication interfaces, power supplies, and input/output modular devices.
1. ACUs shall either reside on the LonTalk FTT-10a network or provide data using LonMark standard network variable types and configuration properties.
  2. All ACUs shall be provided with LED type annunciation to continually display its operational mode, power and communications.
  3. Each ACU shall have sufficient memory to support its operating system, database including the following:
    - a. Data sharing.
    - b. Device and network management.
    - c. Alarm and event management.
    - d. Scheduling.
    - e. Energy Management.
  4. Each ACU shall support firmware upgrades without the need to replace hardware and shall have a minimum of 15 percent spare capacity of I/O functions. The type of spares shall be in the same proportion as the implemented functions on the controller, but in no case there shall be less than one point of each implemented I/O type.
  5. Each ACU shall continuously perform self-diagnostics, communication diagnosis, and provide both local and remote annunciation of any detected component failures, low battery condition; and upon failure shall assume the predetermined failure mode.
  6. In the event of loss of normal power, there shall be orderly shut down of the controllers to prevent the loss of database or software programming. When power is restored flash memory, battery backup or super capacitor will be automatically loaded into non-volatile flash memory and shall be incorporated for all programming data.
- B. Unitary Control Units (UCUs) shall be microprocessor-based. They shall be capable of stand-alone operation, continuing to provide stable control functions if communication is lost with the rest of the system.
1. Unitary Control Units shall either reside on the LonTalk FTT-10a network or provide data using LonMark standard network variable types and configuration properties.

2. Each UCU shall have sufficient memory to support its own operating system, including data sharing.
  3. All UCUs shall be provided with LED type annunciation to continually display its operational mode, power and communications.
  4. In the event of loss of normal power, there shall be orderly shut down of the controllers to prevent the loss of database or software programming. When power is restored flash memory, battery backup or super capacitor will be automatically loaded into non-volatile flash memory and shall be incorporated for all programming data.
- C. Provide I/O module that connects sensors and actuators onto the field bus network for use by the direct digital controllers. I/O devices shall support the communication technology specified for each controller.
1. Analog input shall allow the monitoring of low voltage (0-10 VDC), current (4-20 ma), or resistance signals (thermistor, RTD). Analog input shall be compatible with, and field configurable to commonly available sensing devices. Analog output shall provide a modulating signal for these control devices.
  2. Binary inputs shall allow the monitoring of on/off signals from remote devices. Binary inputs shall provide a wetting current of at least 12 milliamps to be compatible with commonly available control devices. Binary outputs shall provide on/off operation, or a pulsed low voltage signal for pulse width modulation control. Outputs shall be selectable for either normally open or normally closed operation.
  3. Binary outputs on remote and auxiliary controllers shall have 3-position (on/off/auto) override switches and status lights. Analog outputs on remote and auxiliary controllers shall have status lights and a 2-position (auto/manual) switch and manually adjustable potentiometer for manual override.
  4. Each output point shall be provided with a light emitting diode (LED) to indicate status of outputs.
- D. Communication Ports:
1. NACs controllers in the DDC systems shall be connected in a system local area network using protocol defined by ASHRAE Standard 135, BACnet protocol.
  2. The control supplier shall provide connectors, repeaters, hubs, and routers necessary for inter-network communication.



3. Minimum baud rate between the peer-to-peer controllers in the system LAN shall be maintained at the rate of 10 Mbps. Minimum baud for the low level controllers between UCUs and ACUs, ACUs and NAC's shall be maintained at the rate of 76 Kbps.
4. Provide RS-232 port with DB-9 or RJ-11 connector for communication with each controller that will allow direct connection of standard printers, operator terminals, modems, and portable laptop operator's terminal. Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.
5. Database, such as points; status information, reports, system software, custom programs of any one controller shall be readable by any other controller on the network.

### **2.3 DIRECT DIGITAL CONTROLLER SOFTWARE**

- A. The software programs specified in this section shall be commercially available, concurrent, multi-tasking operating system and support the use of software application that operates under DOS or Microsoft Windows.
- B. All points shall be identified by up to 30-character point name and 16-character point descriptor. The same names shall be used at the operator workstation.
- C. All control functions shall execute within the stand-alone control units via DDC algorithms. The VA shall be able to customize control strategies and sequences of operations defining the appropriate control loop algorithms and choosing the optimum loop parameters.
- D. All CU's shall be capable of being programmed to utilize stored default values for assured fail-safe operation of critical processes. Default values shall be invoked upon sensor failure or, if the primary value is normally provided by the central or another CU, or by loss of bus communication. Individual application software packages shall be structured to assume a fail-safe condition upon loss of input sensors. Loss of an input sensor shall result in output of a sensor-failed message at the ECC workstation. Each ACU and RCU shall have capability for local readouts of all functions. The UCUs shall be read remotely.
- E. All DDC control loops shall be able to utilize any of the following control modes:
  1. Two position (on-off, slow-fast) control.

2. Proportional control.
  3. Proportional plus integral (PI) control.
  4. Proportional plus integral plus derivative (PID) control. All PID programs shall automatically invoke integral wind up prevention routines whenever the controlled unit is off, under manual control of an automation system or time initiated program.
  5. Automatic tuning of control loops.
- F. System Security: Operator access shall be secured using individual password and operator's name. Passwords shall restrict the operator to the level of object, applications, and system functions assigned to him. A minimum of six (6) levels of security for operator access shall be provided.
- G. Application Software: The CUs shall provide the following programs as a minimum for the purpose of optimizing energy consumption while maintaining comfortable environment for occupants. All application software shall reside and run in the system digital controllers. Editing of the application shall occur at the operator workstation or via a portable workstation, when it is necessary, to access directly the programmable unit.
1. Power Demand Limiting (PDL): Power demand limiting program shall monitor the building power consumption and limit the consumption of electricity to prevent peak demand charges. PDL shall continuously track the electricity consumption from a pulse input generated at the kilowatt-hour/demand electric meter. PDL shall sample the meter data to continuously forecast the electric demand likely to be used during successive time intervals. If the forecast demand indicates that electricity usage will likely to exceed a user preset maximum allowable level, then PDL shall automatically shed electrical loads. Once the demand load has met, loads that have been shed shall be restored and returned to normal mode. Control system shall be capable of demand limiting by resetting the HVAC system set points to reduce load while maintaining indoor air quality.
  2. Economizer: An economizer program shall be provided for VAV systems. This program shall control the position of air handler relief, return, and outdoors dampers. If the outdoor air dry bulb temperature falls below changeover set point the energy control center will modulate the dampers to provide 100 percent outdoor air.

- The operator shall be able to override the economizer cycle and return to minimum outdoor air operation at any time.
3. Night Setback/Morning Warm up Control: The system shall provide the ability to automatically adjust set points for this mode of operation.
  4. Optimum Start/Stop (OSS): Optimum start/stop program shall automatically be coordinated with event scheduling. The OSS program shall start HVAC equipment at the latest possible time that will allow the equipment to achieve the desired zone condition by the time of occupancy, and it shall also shut down HVAC equipment at the earliest possible time before the end of the occupancy period and still maintain desired comfort conditions. The OSS program shall consider both outside weather conditions and inside zone conditions. The program shall automatically assign longer lead times for weekend and holiday shutdowns. The program shall poll all zones served by the associated AHU and shall select the warmest and coolest zones. These shall be used in the start time calculation. It shall be possible to assign occupancy start times on a per air handler unit basis. The program shall meet the local code requirements for minimum outdoor air while the building is occupied. Modification of assigned occupancy start/stop times shall be possible via operator's workstation.
  5. Event Scheduling: Provide a comprehensive menu driven program to automatically start and stop designated points or a group of points according to a stored time. This program shall provide the capability to individually command a point or group of points. When points are assigned to one common load group it shall be possible to assign variable time advances/delays between each successive start or stop within that group. Scheduling shall be calendar based and advance schedules may be defined up to one year in advance. Advance schedule shall override the day-to-day schedule. The operator shall be able to define the following information:
    - a. Time, day.
    - b. Commands such as on, off, auto.
    - c. Time delays between successive commands.
    - d. Manual overriding of each schedule.
    - e. Allow operator intervention.

6. Alarm Reporting: The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the appropriate workstations based on time and events. An alarm shall be able to start programs, login the event, print and display the messages. The system shall allow the operator to prioritize the alarms to minimize nuisance reporting and to speed operator's response to critical alarms. A minimum of six (6) priority levels of alarms shall be provided for each point.
7. Remote Communications: The system shall have the ability to dial out in the event of an alarm to workstations and alpha-numeric pagers. The alarm message shall include the name of the calling location, the device that generated the alarm, and the alarm message itself. The operator shall be able to remotely access and operate the system using dial up communications. Remote access shall allow the operator to function the same as local access.
8. Maintenance Management (PM): The program shall monitor equipment status and generate maintenance messages based upon the operators defined equipment run time, starts, and/or calendar date limits. A preventative maintenance alarm shall be printed indicating maintenance requirements based on pre-defined run time. Each preventive message shall include point description, limit criteria and preventative maintenance instruction assigned to that limit. A Minimum of 480-character PM shall be provided for each component of units such as air handling units.

#### **2.4 SENSORS (AIR, WATER AND STEAM)**

##### **A. Temperature and Humidity Sensors:**

1. Electronic Sensors: Provide all remote sensors as required for the systems. All sensors shall be vibration and corrosion resistant for wall, immersion, and/or duct mounting.
  - a. Temperature Sensors: Thermistor type for terminal units and Resistance Temperature Device (RTD) with an integral transmitter type for all other sensors.
    - 1) Duct sensors shall be rigid or averaging type as shown on drawings. Averaging sensor shall be a minimum of 1 linear ft of sensing element for each sq ft of cooling coil face area.
    - 2) Immersion sensors shall be provided with a separable well made of stainless steel, bronze or monel material. Pressure rating

of well is to be consistent with the system pressure in which it is to be installed.

- 3) Space sensors shall be equipped with set-point adjustment, override switch, display, and/or communication port as shown on the drawings. Match room thermostats, locking cover.
  - 4) Outdoor air temperature sensors shall have watertight inlet fittings and be shielded from direct sunlight.
  - 5) Room security sensors shall have stainless steel cover plate with insulated back and security screws.
  - 6) Wire: Twisted, shielded-pair cable.
  - 7) Output Signal: 4-20 ma.
- b. Humidity Sensors: Bulk polymer sensing element type.
- 1) Duct and room sensors shall have a sensing range of 20 to 80 percent with accuracy of  $\pm 2$  to  $\pm 5$  percent RH, including hysteresis, linearity, and repeatability.
  - 2) Outdoor humidity sensors shall be furnished with element guard and mounting plate and have a sensing range of 0 to 100 percent RH.
  - 3) 4-20 ma continuous output signal.
- c. Static Pressure Sensors: Non-directional, temperature compensated.
- 1) 4-20 ma output signal.
  - 2) 0 to 5 inches wg for duct static pressure range.
  - 3) 0 to 0.25 inch wg for Building static pressure range.
2. Pneumatic sensors: Shall be vibration and corrosion resistant.
- a. Room temperature sensors shall be linear-output type, 45 to 85 degrees F range, with bimetal sensing element, blank locking covers matching room thermostats.
  - b. Duct-mounted sensors shall be rigid, corrosion resistant construction and/or averaging sensor type. Averaging sensor shall be of single or multiple-unit capillary elements, 3-15 psig linear output signal and temperature range as shown on drawings.
  - c. Humidity Sensor: one-pipe, direct acting, with minimum sensing span of 15-85% relative humidity for 3-15 psig output signal, corrosion resistant, temperature compensated. Space mounted sensor shall match thermostats covers.

- d. Differential Air Pressure Transmitter: One pipe direct acting, diaphragm type, temperature compensated; accuracy within 5 percent of full scale, and 3-15 psig output signal.
- B. Flow switches:
  - 1. Shall be either paddle or differential pressure type.
    - a. Paddle-type switches (liquid service only) shall be UL Listed, SPDT snap-acting, adjustable sensitivity with NEMA 4 enclosure.
    - b. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap acting, NEMA 4 enclosure, with scale range and differential suitable for specified application.
- C. Current Switches: Current operated switches shall be self powered, solid state with adjustable trip current as well as status, power, and relay command status LED indication. The switches shall be selected to match the current of the application and output requirements of the DDC systems.

## **2.5 ENGINEERING CONTROL CENTER (ECC)—OPERATOR'S WORKSTATION**

- A. Operator workstation(s) shall utilize standard Web Browser software and be able to access data from all the digital controllers distributed throughout the control systems. These workstations shall reside on the same high-speed network as the Network Area Controllers with the ability to remote dial or internet access to the system.
- B. The ECC shall consist of the following:
  - 1. Personal Computer: Existing computer workstation shall be utilized for system access
- C. ECC Software:
  - 1. The Controls Systems Operator Interfaces shall be user friendly, readily understood and shall make maximum use of colors, graphics, icons, embedded images, animation, text based information and data visualization techniques to enhance and simplify the use and understanding of the displays by authorized users at the ECC.
  - 2. User access shall be protected by a flexible and Owner re-definable software-based password access protection. Password protection shall be multi-level and partitionable to accommodate the varied access requirements of the different user groups to which individual users may be assigned. Provide the means to define unique access privileges for each individual authorized user. Provide the means to on-line manage password access control under the control of a

- project specific Master Password. Provide an audit trail of all user activity on the Controls Systems including all actions and changes.
3. Operator Workstation shall be user friendly, easily understood and commercially available software, multi-tasking operating system. The operating system shall be Window NT or Windows 2000 XP or better, and shall support the third party software.
- D. The system shall be completely field-programmable from the common operator's keyboard thus allowing hard disk storage of all data automatically. All programs for the CUs shall be able to be downloaded from the hard disk. The software shall provide the following functionality as a minimum:
1. Point database editing, storage and downloading of controller databases.
  2. Scheduling and override of building environmental control systems.
  3. Collection and analysis of historical data.
  4. Alarm reporting, routing, messaging, and acknowledgement.
  5. Definition and construction of dynamic color graphic displays.
  6. Real-time graphical viewing and control of environment.
  7. Scheduling trend reports.
  8. Program editing.
  9. Operating activity log and system security.
  10. Transfer data to third party software.
- E. Provide graphical user software, which shall minimize the use of keyboard through the use of the mouse and "point and click" approach to menu selection.
- F. The software shall provide a multi-tasking type environment that will allow the user to run several applications simultaneously. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able automatically export data to and work in Microsoft Word, Excel, and other Windows based software programs, while concurrently on-line system alarms and monitoring information.
- G. Provide functionality such that using the least amount of steps to initiate the desired event may perform any of the following simultaneously:
1. Dynamic color graphics and graphic control.
  2. Alarm management.

3. Event scheduling.
4. Dynamic trend definition and presentation.
5. Program and database editing.
6. Each operator shall be required to log on to the system with a user name and password to view, edit or delete the data. System security shall be selectable for each operator, and the password shall be able to restrict the operator's access for viewing and changing the system programs. Each operator shall automatically be logged off the system if no keyboard or mouse activity is detected for a selected time.

H. Graphic Displays:

1. The workstation shall allow the operator to access various system schematics and floor plans via a graphical penetration scheme, menu selection, or text based commands. Graphic software shall permit the importing of AutoCAD or scanned pictures in the industry standard format (such as PCX, BMP, GIF, and JPEG) for use in the system.
2. Dynamic temperature values, humidity values, flow rates, and status indication shall be shown in their locations and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh values.
3. Color shall be used to indicate status and change in status of the equipment. The state colors shall be user definable.
4. A clipart library of HVAC equipment, such as chillers, boilers, air handling units, fans, terminal units, pumps, coils, standard ductwork, piping, valves and laboratory symbols shall be provided in the system. The operator shall have the ability to add custom symbols to the clipart library.
5. A dynamic display of the site-specific architecture showing status of the controllers, PC workstations and network shall be provided.
6. The windowing environment of the workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of graphic associated with an alarm to be viewed without interrupting work in progress. The graphic system software shall also have the capability to split screen, half portion of the screen with graphical representation and the other half with sequence of operation of the same HVAC system.



I. Trend reports shall be generated on demand or pre-defined schedule and directed to monitor display, printers or disk. As a minimum, the system shall allow the operator to easily obtain the following types of reports:

1. A general list of all selected points in the network.
2. List of all points in the alarm.
3. List of all points in the override status.
4. List of all disabled points.
5. List of all points currently locked out.
6. List of user accounts and password access levels.
7. List of weekly schedules.
8. List of holiday programming.
9. List of limits and dead bands.
10. Custom reports.
11. System diagnostic reports, including, list of digital controllers on the network.
12. List of programs.

J. Scheduling and Override:

1. Provide a calendar type format for time-of-day scheduling and overrides of building control systems. Schedules reside in the PC workstation, digital controllers shall ensure equipment time scheduling when PC is off-line. PC shall not be required to execute time scheduling. Provide override access through menu selection or function key. Provide the following spreadsheet graphics as a minimum:
  - a. Weekly schedules.
  - b. Zone schedules, minimum of 100 zones.
  - c. Scheduling up to 365 days in advance.
  - d. Scheduled reports to print at workstation.

K. Collection and Analysis of Historical Data:

1. Provide trending capabilities that will allow the operator to monitor and store records of system activity over an extended period of time. Points may be trended automatically on time based intervals or change of value, both of which shall be user definable. The trend interval could be five (5) minutes to 120 hours. Trend data may be stored on hard disk for future diagnostic and reporting.

- Additionally trend data may be archived to network drives or removable disk media for off-site retrieval.
2. Reports may be customized to include individual points or predefined groups of at least six points. Provide additional functionality to allow pre-defined groups of up to 250 trended points to be easily accessible by other industry standard word processing and spreadsheet packages. The reports shall be time and date stamped and shall contain a report title and the name of the facility.
  3. System shall have the set up to generate spreadsheet reports to track energy usage and cost based on weekly or monthly interval, equipment run times, equipment efficiency, and/or building environmental conditions.
  4. Provide additional functionality that will allow the operator to view real time trend data on trend graph displays. A minimum of 20 points may be graphed regardless of whether they have been predefined for trending. In addition, the user may pause the graph and take snapshots of the screens to be stored on the workstation disk for future reference and trend analysis. Exact point values may be viewed and the graph may be printed. Operator shall be able to command points directly on the trend plot by double clicking on the point.
- L. Alarm Management:
1. Alarm routing shall allow the operator to send alarm notification to selected printers or operator workstation based on time of day, alarm severity, or point type.
  2. Alarm notification shall be provided via two alarm icons, to distinguish between routine, maintenance type alarms and critical alarms. The critical alarms shall display on the screen at the time of its occurrence, while others shall display by clicking on their icon.
  3. Alarm display shall list the alarms with highest priority at the top of the display. The alarm display shall provide selector buttons for display of the associated point graphic and message in English language. The operator shall be able to sort out the alarms.
  4. Alarm messages shall be customized for each point to display detailed instructions to the operator regarding actions to take in the event of an alarm.

5. An operator with proper security level access may acknowledge and clear the alarm. All that have not been cleared shall be archived at workstation disk.

M. Clock Synchronization:

The system shall be able to automatically synchronize all system clocks from any operator-designated device in the system, and shall adjust for daylight savings and standard time, if applicable. In the event of a power failure, all clocks shall be adjusted on the command of an operator if the power outage is extended beyond 72 hours.

N. Remote Communications:

The system shall have the ability to dial out in the event of an alarm. Receivers shall include operator workstations, e-mail addresses, and alpha-numeric pagers. The alarm message shall include the name of the calling location, the device that generated the alarm, and the alarm message itself.

O. System Configuration:

1. Network control strategies shall not be restricted to a single digital controller, but shall be able to include data from all other network devices to allow the development of global control strategies.
2. Provide automatic backup and restore of all digital controller databases on the workstation hard disk. In addition to all backup data, all databases shall be performed while the workstation is on-line without disturbing other system operations.

**2.6 CONTROL CABLES**

As specified in Division 26.

**2.7 THERMOSTATS AND HUMIDISTATS**

A. Room thermostats controlling heating and cooling devices shall have three modes of operation (heating - null or dead band - cooling). Thermostats for patient bedrooms shall have capability of being adjusted to eliminate null or dead band. Wall mounted thermostats shall have manufacturer's recommendation finish, setpoint range and temperature display and external adjustment:

1. Electronic Thermostats: Solid-state, microprocessor based, programmable to daily, weekend, and holiday schedules.

- a. Public Space Thermostat: Public space thermostat shall be a platinum sensor and shall not have a visible means of set point adjustment. Adjustment shall be via the digital controller to which it is connected.
  - b. Patient Room Thermostats: Platinum sensor with set point adjustment and an indicator.
  - c. Psychiatric Patient Room Sensors: Electronic duct sensor as noted under Article 2.4.
  - d. Battery replacement without program loss.
- B. Strap-on thermostats shall be enclosed in a dirt-and-moisture proof housing with fixed temperature switching point and single pole, double throw switch.
- C. Freezestats shall have a minimum of 300 mm (one linear foot) of sensing element for each 0.093 square meter (one square foot) of coil area. A freezing condition at any increment of 300 mm (one foot) anywhere along the sensing element shall be sufficient to operate the thermostatic element.
- D. Room Humidistats: Provide fully proportioning humidistat with adjustable throttling range for accuracy of settings and conservation. The humidistat shall have set point scales shown in percent of relative humidity located on the instrument. Systems showing moist/dry or high/low are not acceptable.

## **2.8 SPECIAL CONTROLLERS**

- A. Room Differential Pressure Controller: The differential pressure in laboratory rooms, operating rooms and isolation rooms shall be maintained by controlling the quantity of air exhausted from or supplied to the room. A sensor-controller shall measure and control the velocity of air flowing into or out of the room through a sampling tube installed in the wall separating the room from the adjacent space, and display the value on its monitor. The sensor controller shall meet the following as a minimum:
- 1. Operating range: -0.200000 to +0.200000 inches of water
  - 2. Resolution: 5 percent of reading
  - 3. Accuracy: +/- 10 percent of reading +/- 0.00001 inches of water
  - 4. Analog output: 0-10 VDC or 4-20 ma
  - 5. Operating temperature range: 32-120 degrees F

## 2.9 FINAL CONTROL ELEMENTS AND OPERATORS

- A. Fail Safe Operation: Control valves and dampers shall provide "fail safe" operation in either the normally open or normally closed position as required for freeze, moisture, and smoke or fire protection.
- B. Spring Ranges: Range as required for system sequencing and to provide tight shut-off.
- C. Power Operated Control Dampers (other than VAV Boxes): Factory fabricated, balanced type dampers. All modulating dampers shall be opposed blade type and gasketed. Blades for two-position, duct-mounted dampers shall be parallel, airfoil (streamlined) type for minimum noise generation and pressure drop.
  - 1. Leakage: Except as specified in subparagraph 2 below, maximum leakage in closed position shall not exceed 7 L/S (15 CFMs) differential pressure for outside air and exhaust dampers and 200 L/S/ square meter (40 CFM/sq. ft.) at 50 mm (2 inches) differential pressure for other dampers.
  - 2. Frame shall be galvanized steel channel with seals as required to meet leakage criteria.
  - 3. Blades shall be galvanized steel or aluminum, 200 mm (8 inch) maximum width, with edges sealed as required.
  - 4. Bearing shall be nylon, bronze sleeve or ball type.
  - 5. Hardware shall be zinc-plated steel. Connected rods and linkage shall be non-slip. Working parts of joints shall be brass, bronze, nylon or stainless steel.
- D. Operators shall be electric or pneumatic type operating at 140 kPa (20 psig) as required for proper operation.
  - 1. See drawings for required control operation.
  - 2. Metal parts shall be aluminum, mill finish galvanized steel, or zinc plated steel or stainless steel.
  - 3. Maximum air velocity and pressure drop through free area the dampers:
    - a. Smoke damper in air handling unit; 210 meter per minute (700 fpm).
    - b. Duct mounted damper; 600 meter per minute (2000 fpm).
    - c. Maximum static pressure loss, 50 Pascal (0.20 inches water gage).

- E. Smoke Dampers and Combination Fire/Smoke Dampers: Dampers and operators are specified in Section 23 31 00, HVAC DUCTS AND CASINGS. Control of these dampers is specified under this Section.
- F. Control Valves:
1. Valves shall be rated for a minimum of 150 percent of system operating pressure at the valve location but not less than 900 kPa (125 psig).
  2. Valves 50 mm (2 inches) and smaller shall be bronze body with threaded or flare connections.
  3. Valves 60 mm (2 1/2 inches) and larger shall be bronze or iron body with flanged connections.
  4. Brass or bronze seats except for valves controlling media above 100 degrees C (210 degrees F), which shall have stainless steel seats.
  5. Flow characteristics:
    - a. Three way valves shall have a linear relation or equal percentage relation of flow versus valve position.
    - b. Two-way valves position versus flow relation shall be linear for steam and equal percentage for water flow control.
  6. Maximum pressure drop:
    - a. Two position steam control: 20 percent of inlet gauge pressure.
    - b. Modulating Steam Control: 80 percent of inlet gauge pressure (acoustic velocity limitation).
    - c. Modulating water flow control, greater of 3 meters (10 feet) of water or the pressure drop through the apparatus.
    - d. Two position water valves shall be line size.
- G. Damper and Valve Operators and Relays:
1. Electric damper operator shall provide full modulating control of dampers. A linkage and pushrod shall be furnished for mounting the actuator on the damper frame internally in the duct or externally in the duct or externally on the duct wall, or shall be furnished with a direct-coupled design.
  2. Electronic damper operators: VAV Box actuator shall be mounted on the damper axle or shall be of the air valve design, and shall provide complete modulating control of the damper. The motor shall have a closure torque of 35-inch pounds minimum with full torque applied at close off to attain minimum leakage.

## 2.10 AIR FLOW CONTROL

- A. Airflow and static pressure shall be controlled via digital controller (CUs) with inputs from airflow control measuring stations and static pressure inputs as specified. Controller outputs shall be true analog output signals to pneumatic positioners or variable frequency drives. Pulse width modulation outputs are not acceptable. The CUs shall include the capability to control via simple proportional (P) control, proportional plus integral (PI), proportional plus integral plus derivative (PID), and on-off. The airflow control programs shall be factory-tested programs that are documented in the literature of the control manufacturer.
- B. Air Flow Measuring Station -- Pneumatic Type:
1. Airflow measuring stations shall measure airflow by the pitot tube traverse method. Each unit shall consist of a network of static and total pressure sensors, factory positioned and connected in parallel, to produce an equalized velocity pressure. The measured velocity pressure converted to airflow (cfm) shall have accuracy within 2 percent of the full scale throughout the velocity range from 200 to 1,200 meter per minute (700 to 4,000 fpm).
  2. Airflow measuring stations shall consist of 16-gauge sheet metal casing, an aluminum air velocity treatment and air straightening section with an open face area not less than 97 percent and a total and static pressure sensing manifold made of copper. Each station shall contain noncombustible sensors which shall be incapable of producing toxic gases or fumes in the event of elevated duct temperatures. All interconnecting tubing shall be internal to the unit with the exception of one total pressure and one static pressure meter connection.
  3. Each air flow measuring station shall be installed to meet at least the manufacturer's minimum installation conditions and shall not amplify the sound level within the duct. The maximum resistance to airflow shall not exceed 0.3 times the velocity head for the duct stations and 0.6 times the velocity head for the fan stations. The unit shall be suitable for continuous operation up to a temperature of 120 degrees C (250 degrees F).
  4. Differential pressure transducers shall measure and transmit pressure signals to the direct digital controller CU.

C. Air Flow Measuring Station -- Electronic Thermal Type:

1. Air Flow Sensor Probe:

- a. Each air flow sensor shall contain two individual thermal sensing elements. One element shall determine the velocity of the air stream while the other element shall compensate for changes in temperature. Each thermal flow sensor and its associated control circuit and signal conditioning circuit shall be factory calibrated and be interchangeable to allow replacement of a sensor without recalibration of the entire flow station. The sensor in the array shall be located at the center of equal area segment of the duct and the number of sensors shall be adequate to accommodate the expected velocity profile and variation in flow and temperature. The airflow station shall be of the insertion type in which sensor support structures are inserted from the outside of the ducts to make up the complete electronic velocity array.
- b. Thermal flow sensor shall be constructed of hermetically sealed thermistors or nickel chromium or reference grade platinum wire, wound over an epoxy, stainless steel or ceramic mandrel and coated with a material suitable for the conditions to be encountered. Each dual sensor shall be mounted in an extruded aluminum alloy strut.

2. Air Flow Sensor Grid Array:

- a. Each sensor grid shall consist of a lattice network of temperature sensors and linear integral controllers (ICs) situated inside an aluminum casing suitable for mounting in a duct. Each sensor shall be mounted within a strut facing downstream of the airflow and located so that it is protected on the upstream side. All wiring shall be encased (out of the air stream) to protect against mechanical damage.
- b. The casing shall be made of welded aluminum of sufficient strength to prevent structural bending and bowing. Steel or iron composite shall not be acceptable in the casing material.
- c. Pressure drop through the flow station shall not exceed 4 Pascal (0.015" W.G.) at 1,000 meter per minute (3,000 FPM).

3. Electronics Panel:



- a. Electronics Panel shall consist of a surface mounted enclosure complete with solid-state microprocessor and software.
  - b. Electronics Panel shall be A/C powered 24 VAC and shall have the capability to transmit signals of 0-5 VDC, 0-10 VCD or 4-20 ma for use in control of the HVAC Systems. The electronic panel shall have the capability to accept user defined scaling parameters for all output signals.
  - c. Electronics Panel shall have the capability to digitally display airflow in CFM and temperature in degrees F. The displays shall be provided as an integral part of the electronics panel. The electronic panel shall have the capability to totalize the output flow in CFM for two or more systems, as required. A single output signal may be provided which will equal the sum of the systems totalized. Output signals shall be provided for temperature and airflow. Provide remote mounted air flow or temperature displays where indicated on the plans.
  - d. Electronics Panel shall have the following:
    - 1) Minimum of 12-bit A/D conversion.
    - 2) Field adjustable digital primary output offset and gain.
    - 3) Airflow analog output scaling of 100 to 10,000 FPM.
    - 4) Temperature analog output scaling from -45 to 70 degrees C (-50 to 160 degrees F).
    - 5) Analog output resolution (full scale output) of 0.025%.
  - e. All readings shall be in I.P. units.
4. Thermal flow sensors and its electronics shall be installed as per manufacturer's instructions. The probe sensor density shall be as follows:

Probe Sensor Density	
Area (sq.ft.)	Qty. Sensors
<=1	2
>1 to <4	4
4 to <8	6
8 to <12	8
12 to <16	12
>=16	16

- a. Complete installation shall not exhibit more than  $\pm 2.0\%$  error in airflow measurement output for variations in the angle of flow of

up to 10 percent in any direction from its calibrated orientation. Repeatability of readings shall be within  $\pm 0.25\%$ .

D. Static Pressure Measuring Station:

1. Static Pressure Control:

a. Systems shall consist of one or more static pressure sensors and transmitters along with relays or auxiliary devices as required for a complete functional system. The span of the transmitter shall not exceed two times the design static pressure at the point of measurement. The output of the transmitter shall be true representation of the input pressure with plus or minus 25 Pascal (0.1 inch) W.G. of the true input pressure.

1) Static pressure sensors shall have the same requirements as Airflow Measuring Devices except that total pressure sensors are optional, and only multiple static pressure sensors positioned on an equal area basis connected to a network of headers are required.

2) For systems with multiple major trunk supply ducts, furnish a static pressure transmitter for each trunk duct. The transmitter signal representing the lowest static pressure shall be selected and this shall be the input signal to the CU.

3) The CU shall receive the static pressure transmitter signal and CU shall provide a control output signal to the supply fan capacity control device. The control mode shall be proportional plus integral (PI) (automatic reset) and where required shall also include derivative mode.

4) In systems with multiple static pressure transmitters, provide a switch located near the fan discharge to prevent excessive pressure during abnormal operating conditions.

E. Constant Volume Control:

1. Systems shall consist of an air flow measuring station along with such relays and auxiliary devices as required to produce a complete functional system. The transmitter shall receive its air flow signal and static pressure signal from the flow measuring station and shall have a span not exceeding three times the design flow rate. The CU shall receive the transmitter signal and shall provide an output to the fan volume control device to maintain a constant flow rate. The

CU shall provide proportional plus integral (PI) (automatic reset) control mode and where required also inverse derivative mode. Overall system accuracy shall be plus or minus the equivalent of 2 Pascal (0.008 inch) velocity pressure as measured by the flow station.

F. Airflow Synchronization:

1. Systems shall consist of an air flow measuring station for each supply and return duct, the CU and such relays, as required to provide a complete functional system that will maintain a constant flow rate difference between supply and return air to an accuracy of  $\pm 10\%$ . In systems where there is no suitable location for a flow measuring station that will sense total supply or return flow, provide multiple flow stations with a differential pressure transmitter for each station. Signals from the multiple transmitters shall be added through the CU such that the resultant signal is a true representation of total flow.
2. The total flow signals from supply and return air shall be the input signals to the CU. This CU shall track the return air fan capacity in proportion to the supply air flow under all conditions.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. General:

1. Examine project plans for control devices and equipment locations; and report any discrepancies, conflicts, or omissions to COTR for resolution before proceeding for installation.
2. Work Coordination: See GENERAL CONDITIONS.
3. Install equipment, piping, wiring /conduit parallel to or at right angles to building lines.
4. Install all equipment and piping in readily accessible locations. Do not run tubing and conduit concealed under insulation or inside ducts.
5. Mount control devices, tubing and conduit located on ducts and apparatus with external insulation on standoff support to avoid interference with insulation.
6. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

7. Run tubing and wire connecting devices on or in control cabinets parallel with the sides of the cabinet neatly racked to permit tracing.
8. Install equipment level and plum.

B. Piping Installation:

1. All piping associated with smoke control shall be hard drawn copper.
2. Tubing passing through or buried in concrete shall be installed in rigid steel conduit of sufficient strength to prevent damage to tubing.
3. Except for short apparatus connections, non-metallic tubing in all exposed locations, including mechanical rooms shall be protected from damage by installing the tubing in electric conduit or raceways. Provide protective grommet where tubing exits conduit.
4. Non-metallic tubing exposed to outdoors shall be protected by a sleeve or larger tubing.
5. In concealed but accessible locations such as above lay-in ceilings, non-metallic tubing may be run without conduit or raceway.
6. All tubing which is not run in conduit or raceway, both metallic and non-metallic, shall be neatly routed and securely fastened to building structure at not more than 36-IN. intervals.
7. Welding shall be performed in accordance with Section 23 21 13, HYDRONIC PIPING.
8. Label and identify control air piping in accordance with specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

C. Electrical Wiring Installation:

1. Install conduits and wiring in accordance with Specification Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.
2. Install signal and communication cables in accordance with Specification Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).
3. Install conduit and wiring between operator workstation(s), digital controllers, electrical panels, indicating devices, instrumentation, miscellaneous alarm points, thermostats, and relays as shown on the drawings or as required under this section. All wiring shall be installed in conduits.
4. Install all electrical work required for a fully functional system and not shown on electrical plans or required by electrical

specifications. Where low voltage power is required, provide suitable transformers.

5. Install all system components in accordance with local Building Code and National Electric Code.
    - a. Splices: Splices in shielded and coaxial cables shall consist of terminations and the use of shielded cable couplers. Terminations shall be in accessible locations. Cables shall be harnessed with cable ties.
    - b. Equipment: Fit all equipment contained in cabinets or panels with service loops, each loop being at least 300 mm (12 inches) long. Equipment for fiber optics system shall be rack mounted, as applicable, in ventilated, self-supporting, code gauge steel enclosure. Cables shall be supported for minimum sag.
    - c. Cable Runs: Keep cable runs as short as possible. Allow extra length for connecting to the terminal board. Do not bend flexible coaxial cables in a radius less than ten times the cable outside diameter.
    - d. Use vinyl tape, sleeves, or grommets to protect cables from vibration at points where they pass around sharp corners, through walls, panel cabinets, etc.
  6. Conceal cables, except in mechanical rooms and areas where other conduits and piping are exposed.
  7. Permanently label or code each point of all field terminal strips to show the instrument or item served. Color-coded cable with cable diagrams may be used to accomplish cable identification.
  8. Grounding: ground electrical systems per manufacturer's written requirements for proper and safe operation.
- D. Install Sensors and Controls:
1. Temperature Sensors:
    - a. Install all sensors and instrumentation according to manufacturer's written instructions. Temperature sensor locations shall be readily accessible, permitting quick replacement and servicing of them without special skills and tools.
    - b. Calibrate sensors to accuracy specified, if not factory calibrated.
    - c. Use of sensors shall be limited to its duty, e.g., duct sensor shall not be used in lieu of room sensor.

- d. Install room sensors permanently supported on wall frame. They shall be mounted at 1.5 meter (5.0 feet) above the finished floor.
  - e. Mount sensors rigidly and adequately for the environment within which the sensor operates.
  - f. Sensors used in mixing plenum, and hot and cold decks shall be of the averaging of type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.
  - g. All pipe mounted temperature sensors shall be installed in wells.
  - h. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor reading.
  - i. Permanently mark terminal blocks for identification. Protect all circuits to avoid interruption of service due to short-circuiting or other conditions. Line-protect all wiring that comes from external sources to the site from lightning and static electricity.
2. Pressure Sensors:
- a. Install duct static pressure sensor tips facing directly downstream of airflow.
  - b. Install high-pressure side of the differential switch between the pump discharge and the check valve.
  - c. Install snubbers and isolation valves on steam pressure sensing devices.
3. Actuators:
- a. Mount and link damper and valve actuators according to manufacturer's written instructions.
  - b. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed position.
  - c. Check operation of valve/actuator combination to confirm that actuator modulates valve smoothly in both open and closed position.
4. Flow Switches:
- a. Install flow switch according to manufacturer's written instructions.

- b. Mount flow switch a minimum of 5 pipe diameters up stream and 5 pipe diameters downstream or 600 mm (2 feet) whichever is greater, from fittings and other obstructions.
  - c. Assure correct flow direction and alignment.
  - d. Mount in horizontal piping-flow switch on top of the pipe.
- E. Installation of Network:
1. Ethernet:
    - a. The network shall employ Ethernet LAN architecture, as defined by IEEE 802.3. The Network Interface shall be fully Internet Protocol (IP) compliant allowing connection to currently installed IEEE 802.3, Compliant Ethernet Networks.
    - b. The network shall directly support connectivity to a variety of cabling types. As a minimum provide the following connectivity: 10 Base 2 (ThinNet RG-58 A/U Coaxial cabling with BNC connectors), 10 Base T (Twisted-Pair RJ-45 terminated UTP cabling).
  2. Echelon:
    - a. The ECC shall employ LonTalk communications FTT-10.
    - b. Echelon LAN (Flat LON): The ECC shall employ a LON LAN that will connect through an Echelon Communication card directly to all controllers on the FTT-10 LAN.
  3. Third Party Interfaces: Contractor shall integrate real-time data from building systems by other trades and databases originating from other manufacturers as specified and required to make the system work as one system.
- F. Installation of Digital Controllers and Programming:
1. Provide a separate digital control panel for each major piece of equipment, such as air handling unit, chiller, pumping unit etc. Points used for control loop reset such as outdoor air, outdoor humidity, or space temperature could be located on any of the remote control units.
  2. Provide sufficient internal memory for the specified control sequences and trend logging. There shall be a minimum of 25 percent of available memory free for future use.
  3. System point names shall be modular in design, permitting easy operator interface without the use of a written point index.

4. Provide software programming for the applications intended for the systems specified, and adhere to the strategy algorithms provided.
5. Provide graphics for each piece of equipment and floor plan in the building. This includes each chiller, cooling tower, air handling unit, fan, terminal unit, boiler, pumping unit etc. These graphics shall show all points dynamically as specified in the point list.

### **3.2 SYSTEM VALIDATION AND DEMONSTRATION**

- A. As part of final system acceptance, a System Demonstration is required (see below). Prior to start of this Demonstration, the contractor is to perform a complete Validation of all aspects of the Controls and Instrumentation System.
- B. Validation
  1. Prepare and submit for approval a Validation Test Plan including Test Procedures for the performance verification tests. Test Plan shall address all specified functions of the Engineering Control Center and all specified sequences of operation. Explain in detail actions and expected results used to demonstrate compliance with the requirements of this specification. Explain the method for simulating the necessary conditions of operation used to demonstrate performance of the system. Test Plan shall include a Test Check List to be used by the Installer's agent to check and initial that each test has been successfully completed. Deliver Test Plan documentation for the performance verification tests to the owner's representative 30 days prior to start of performance verification tests. Provide draft copy of operation and maintenance manual with performance verification test.
  2. After approval of the Validation Test Plan, Installer shall carry out all tests and procedures therein. Installer shall completely check out, calibrate, and test all connected hardware and software to insure that system performs in accordance with approved specifications and sequences of operation submitted. Installer shall complete and submit Test Check List.
- C. DEMONSTRATION
  1. System operation and calibration to be demonstrated by the Installer in the presence of the Architect or Owner's representative on random samples of equipment as dictated by the Owner's representative. Should random sampling indicate improper commissioning, the owner



reserves the right to subsequently witness complete calibration of the system at no addition cost to the owner.

2. Demonstrate to authorities that all required safeties and life safety functions are fully functional and complete.
3. Make accessible , personnel to provide necessary adjustments and corrections to systems as directed by balancing agency.
4. The following witnessed demonstrations of field control equipment shall be included:
  - a. Pressure test control air piping at 1.25 times the design pressure. Pressure shall be applied in several stages, allowing time for the system to reach equilibrium. The test pressure shall not exceed the pneumatic test pressure for any pump, valve, or other component in the system under test. Pressure shall not drop more than 5% within 4 hours.
  - b. Observe HVAC systems in shut down condition. Check dampers and valves for normal position.
  - c. Test application software for its ability to communicate with digital controllers, operator workstation, and uploading and downloading of control programs.
  - d. Demonstrate the software ability to edit the control program off-line.
  - e. Demonstrate reporting of alarm conditions for each alarm and ensure that these alarms are received at the assigned location, including operator workstations.
  - f. Demonstrate ability of software program to function for the intended applications-trend reports, change in status etc.
  - g. Demonstrate via graphed trends to show the sequence of operation is executed in correct manner, and that the HVAC systems operate properly through the complete sequence of operation, e.g., seasonal change, occupied/unoccupied mode, and warm-up condition.
  - h. Demonstrate hardware interlocks and safeties functions, and that the control systems perform the correct sequence of operation after power loss and resumption of power loss.
  - i. Prepare and deliver to the VA graphed trends of all control loops to demonstrate that each control loop is stable and the set points are maintained.

- j. Demonstrate that each control loop responds to set point adjustment and stabilizes within one (1) minute. Control loop trend data shall be instantaneous and the time between data points shall not be greater than one (1) minute.
5. Witnessed validation demonstration of Operator's Terminal functions shall consist of:
- a. Running each specified report.
  - b. Display and demonstrate each data entry to show site specific customizing capability. Demonstrate parameter changes.
  - c. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
  - d. Execute digital and analog commands in graphic mode.
  - e. Demonstrate DDC loop precision and stability via trend logs of inputs and outputs (6 loops minimum).
  - f. Demonstrate EMS performance via trend logs and command trace.
  - g. Demonstrate scan, update, and alarm responsiveness.
  - h. Demonstrate spreadsheet/curve plot software, and its integration with database.
  - i. Demonstrate on-line user guide, and help function and mail facility.
  - j. Demonstrate digital system configuration graphics with interactive upline and downline load, and demonstrate specified diagnostics.
  - k. Demonstrate multitasking by showing dynamic curve plot, and graphic construction operating simultaneously via split screen.
  - l. Demonstrate class programming with point options of beep duration, beep rate, alarm archiving, and color banding.

----- END -----

**SECTION 23 21 13**  
**HYDRONIC PIPING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Water piping to connect HVAC equipment, including the following:
  - 1. Heating hot water piping.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION:  
General mechanical requirements and items, which are common to more than one section of Division 23.
- D. Section 23 07 11, HVAC, and BOILER PLANT INSULATION: Piping insulation.

**1.3 QUALITY ASSURANCE**

- A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION, which includes welding qualifications.
- B. Submit prior to welding of steel piping a certificate of Welder's certification. The certificate shall be current and not more than one year old.
- C. For mechanical pressed sealed fittings, only tools of fitting manufacturer shall be used.
- D. **Pressed fittings ARE NO LONGER APPROVED ON VETERAN ADMINISTRATION PROJECTS FOR HYDRONIC PIPING.**
- E. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be the same manufacturer as the grooved components.
  - 1. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Pipe and equipment supports.
  - 2. Pipe and tubing, with specification, class or type, and schedule.
  - 3. Pipe fittings, including miscellaneous adapters and special fittings.
  - 4. Flanges, gaskets and bolting.

5. Grooved joint couplings and fittings.
  6. Valves of all types.
  7. Strainers.
  8. Flexible connectors for water service.
  9. Pipe alignment guides.
  10. Expansion joints.
  11. Expansion compensators.
  12. All specified hydronic system components.
  13. Water flow measuring devices.
  14. Gages.
  15. Thermometers and test wells.
  16. Electric heat tracing systems.
- C. Manufacturer's certified data report, Form No. U-1, for ASME pressure vessels:
1. Heat Exchangers (Water to Water)
  2. Air separators.
  3. Expansion tanks.
- D. Submit the welder's qualifications in the form of a current (less than one year old) and formal certificate.
- E. Coordination Drawings: Refer to Article, SUBMITTALS of Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- F. As-Built Piping Diagrams: Provide drawing as follows for chilled water, condenser water, and heating hot water system and other piping systems and equipment.
1. One wall-mounted stick file with complete set of prints. Mount stick file in the chiller plant or control room along with control diagram stick file.
  2. One complete set of reproducible drawings.
  3. One complete set of drawings in electronic Autocad and pdf format.

#### **1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. American National Standards Institute, Inc.
- B. American Society of Mechanical Engineers/American National Standards Institute, Inc. (ASME/ANSI):
- B1.20.1-83(R2006).....Pipe Threads, General Purpose (Inch)

- B16.4-06.....Gray Iron Threaded FittingsB16.18-01      Cast  
Copper Alloy Solder joint Pressure fittings
- B16.23-02.....Cast Copper Alloy Solder joint Drainage  
fittings
- B40.100-05.....Pressure Gauges and Gauge Attachments
- C. American National Standards Institute, Inc./Fluid Controls Institute  
(ANSI/FCI):
- 70-2-2006.....Control Valve Seat Leakage
- D. American Society of Mechanical Engineers (ASME):
- B16.1-98.....Cast Iron Pipe Flanges and Flanged Fittings
- B16.3-2006.....Malleable Iron Threaded Fittings: Class 150 and  
300
- B16.4-2006.....Gray Iron Threaded Fittings: (Class 125 and  
250)
- B16.5-2003.....Pipe Flanges and Flanged Fittings: NPS ½  
through NPS 24 Metric/Inch Standard
- B16.9-07.....Factory Made Wrought Butt Welding Fittings
- B16.11-05.....Forged Fittings, Socket Welding and Threaded
- B16.18-01.....Cast Copper Alloy Solder Joint Pressure  
Fittings
- B16.22-01.....Wrought Copper and Bronze Solder Joint Pressure  
Fittings.
- B16.24-06.....Cast Copper Alloy Pipe Flanges and Flanged  
Fittings
- B16.39-06.....Malleable Iron Threaded Pipe Unions
- B16.42-06.....Ductile Iron Pipe Flanges and Flanged Fittings
- B31.1-08.....Power Piping
- E. American Society for Testing and Materials (ASTM):
- A47/A47M-99 (2004).....Ferritic Malleable Iron Castings
- A53/A53M-07.....Standard Specification for Pipe, Steel, Black  
and Hot-Dipped, Zinc-Coated, Welded and  
Seamless
- A106/A106M-08.....Standard Specification for Seamless Carbon  
Steel Pipe for High-Temperature Service
- A126-04.....Standard Specification for Gray Iron Castings  
for Valves, Flanges, and Pipe Fittings

A183-03 .....	Standard Specification for Carbon Steel Track Bolts and Nuts
A216/A216M-08 .....	Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service
A234/A234M-07 .....	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
A307-07 .....	Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
A536-84 (2004) .....	Standard Specification for Ductile Iron Castings
A615/A615M-08 .....	Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
A653/A 653M-08 .....	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) By the Hot-Dip Process
B32-08 .....	Standard Specification for Solder Metal
B62-02 .....	Standard Specification for Composition Bronze or Ounce Metal Castings
B88-03 .....	Standard Specification for Seamless Copper Water Tube
B209-07 .....	Aluminum and Aluminum Alloy Sheet and Plate
C177-04 .....	Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus
C478-09 .....	Precast Reinforced Concrete Manhole Sections
C533-07 .....	Calcium Silicate Block and Pipe Thermal Insulation
C552-07 .....	Cellular Glass Thermal Insulation
D3350-08 .....	Polyethylene Plastics Pipe and Fittings Materials
C591-08 .....	Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
D1784-08 .....	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compound

- D1785-06 ..... Poly (Vinyl Chloride) (PVC) Plastic Pipe,  
Schedules 40, 80 and 120
- D2241-05 ..... Poly (Vinyl Chloride) (PVC) Pressure Rated Pipe  
(SDR Series)
- F439-06 ..... Standard Specification for Chlorinated Poly  
(Vinyl Chloride) (CPVC) Plastic Pipe Fittings,  
Schedule 80
- F441/F441M-02 ..... Standard Specification for Chlorinated Poly  
(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules  
40 and 80
- F477-08 ..... Elastomeric Seals Gaskets) for Joining Plastic  
Pipe
- F. American Water Works Association (AWWA):
- C110-08.....Ductile Iron and Grey Iron Fittings for Water
- C203-02.....Coal Tar Protective Coatings and Linings for  
Steel Water Pipe Lines Enamel and Tape Hot  
Applied
- G. American Welding Society (AWS):
- B2.1-02.....Standard Welding Procedure Specification
- H. Copper Development Association, Inc. (CDA):
- CDA A4015-06.....Copper Tube Handbook
- I. Expansion Joint Manufacturer's Association, Inc. (EJMA):
- EMJA-2003.....Expansion Joint Manufacturer's Association  
Standards, Ninth Edition
- J. Manufacturers Standardization Society (MSS) of the Valve and Fitting  
Industry, Inc.:
- SP-67-02a.....Butterfly Valves
- SP-70-06.....Gray Iron Gate Valves, Flanged and Threaded  
Ends
- SP-71-05.....Gray Iron Swing Check Valves, Flanged and  
Threaded Ends
- SP-80-08.....Bronze Gate, Globe, Angle and Check Valves
- SP-85-02.....Cast Iron Globe and Angle Valves, Flanged and  
Threaded Ends
- SP-110-96.....Ball Valves Threaded, Socket-Welding, Solder  
Joint, Grooved and Flared Ends

SP-125-00.....Gray Iron and Ductile Iron In-line, Spring  
Loaded, Center-Guided Check Valves

K. National Sanitation Foundation/American National Standards Institute,  
Inc. (NSF/ANSI):

14-06.....Plastic Piping System Components and Related  
Materials

50-2009a.....Equipment for Swimming Pools, Spas, Hot Tubs  
and other Recreational Water Facilities -  
Evaluation criteria for materials, components,  
products, equipment and systems for use at  
recreational water facilities

61-2008.....Drinking Water System Components - Health  
Effects

L. Tubular Exchanger Manufacturers Association: TEMA 9th Edition, 2007

**1.6 SPARE PARTS**

A. NOT USED

**PART 2 - PRODUCTS**

**2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES**

A. Provide in accordance with Section 23 05 11, COMMON WORK RESULTS FOR  
HVAC and STEAM GENERATION.

**2.2 PIPE AND TUBING**

**PART 2 - PRODUCTS**

**2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES**

A. Provide in accordance with Section 23 05 11, COMMON WORK RESULTS FOR  
HVAC and STEAM GENERATION.

**2.2 PIPE AND TUBING**

A. Heating Hot Water Piping:

1. Steel: ASTM A53 Grade B, seamless or ERW, Schedule 40.
2. Copper water tube option: ASTM B88, Type K or L, hard drawn.

B. Pipe supports, including insulation shields, for above ground piping:  
Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

**2.3 FITTINGS FOR STEEL PIPE**

A. 50 mm (2 inches) and Smaller: Screwed or welded joints.

1. Butt welding: ASME B16.9 with same wall thickness as connecting  
piping.
2. Forged steel, socket welding or threaded: ASME B16.11.



3. Screwed: 150 pound malleable iron, ASME B16.3. 125 pound cast iron, ASME B16.4, may be used in lieu of malleable iron. Bushing reduction of a single pipe size, or use of close nipples, is not acceptable.
  4. Unions: ASME B16.39.
  5. Water hose connection adapter: Brass, pipe thread to 20 mm (3/4 inch) garden hose thread, with hose cap nut.
- B. 65 mm (2-1/2 inches) and Larger: Welded or flanged joints. Contractor's option: Grooved mechanical couplings and fittings are optional.
1. Butt welding fittings: ASME B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.
  2. Welding flanges and bolting: ASME B16.5:
    - a. Water service: Weld neck or slip-on, plain face, with 6 mm (1/8 inch) thick full face neoprene gasket suitable for 104 degrees C (220 degrees F).
      - 1) Contractor's option: Convolute, cold formed 150 pound steel flanges, with teflon gaskets, may be used for water service.
    - b. Flange bolting: Carbon steel machine bolts or studs and nuts, ASTM A307, Grade B.
- C. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and threadolets may be used for branch connections up to one pipe size smaller than the main. Forged steel half-couplings, ASME B16.11 may be used for drain, vent and gage connections.
- D. Grooved Mechanical Pipe Couplings and Fittings (Contractor's Option): Grooved Mechanical Pipe Couplings and Fittings may be used, with cut or roll grooved pipe, in water service up to 110 degrees C (230 degrees F) in lieu of welded, screwed or flanged connections. All joints must be rigid type.
1. Grooved mechanical couplings: Malleable iron, ASTM A47 or ductile iron, ASTM A536, fabricated in two or more parts, securely held together by two or more track-head, square, or oval-neck bolts, ASTM A449 and A183.
  2. Gaskets: Rubber product recommended by the coupling manufacturer for the intended service.
  3. Grooved end fittings: Malleable iron, ASTM A47; ductile iron, ASTM A536; or steel, ASTM A53 or A106, designed to accept grooved mechanical couplings. Tap-in type branch connections are acceptable.

#### **2.4 FITTINGS FOR COPPER TUBING**

##### **A. Joints:**

1. Solder Joints: Joints shall be made up in accordance with recommended practices of the materials applied. Apply 95/5 tin and antimony on all copper piping.
2. Mechanically formed tee connection in water and drain piping: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall insure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting.

B. Bronze Flanges and Flanged Fittings: ASME B16.24.

C. Fittings: ANSI/ASME B16.18 cast copper or ANSI/ASME B16.22 solder wrought copper.

#### **2.5 NOT USED**

#### **2.6 DIELECTRIC FITTINGS**

- A. Provide where copper tubing and ferrous metal pipe are joined.
- B. 2" and smaller, screwed end brass ball valves or dielectric nipples.
- C. 65 mm (2 1/2 inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42.
- D. Temperature Rating, 99 degrees C (210 degrees F).

#### **2.7 SCREWED JOINTS**

- A. Pipe Thread: ANSI B1.20.
- B. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

#### **2.8 VALVES**

- A. Asbestos packing is not acceptable.
- B. All valves of the same type shall be products of a single manufacturer.
- C. Provide chain operators for valves 150 mm (6 inches) and larger when the centerline is located 2400 mm (8 feet) or more above the floor or operating platform.
- D. Shut-Off Valves
  1. Ball Valves (Pipe sizes 2" and smaller): MSS-SP 110, screwed or solder connections, brass or bronze body with chrome-plated ball with full port and Teflon seat at 2760 kPa (400 psig) working

- pressure rating. Provide stem extension to allow operation without interfering with pipe insulation.
2. Butterfly Valves (Pipe Sizes 2-1/2" and larger): Provide stem extension to allow 50 mm (2 inches) of pipe insulation without interfering with valve operation. MSS-SP 67, flange lug type or grooved end rated 1205 kPa (175 psig) working pressure at 93 degrees C (200 degrees F). Valves shall be ANSI Leakage Class VI and rated for bubble tight shut-off to full valve pressure rating. Valve shall be rated for dead end service and bi-directional flow capability to full rated pressure. Not permitted for direct buried pipe applications.
    - a. Body: Cast iron, ASTM A126, Class B. Malleable iron, ASTM A47 electro-plated, or ductile iron, ASTM A536, Grade 65-45-12 electro-plated.
    - b. Trim: Bronze, aluminum bronze, or 300 series stainless steel disc, bronze bearings, 316 stainless steel shaft and manufacturer's recommended resilient seat. Resilient seat shall be field replaceable, and fully line the body to completely isolate the body from the product. A phosphate coated steel shaft or stem is acceptable, if the stem is completely isolated from the product.
    - c. Actuators: Field interchangeable. Valves for balancing service shall have adjustable memory stop to limit open position.
      - 1) Valves 150 mm (6 inches) and smaller: Lever actuator with minimum of seven locking positions, except where chain wheel is required.
      - 2) Valves 200 mm (8 inches) and larger: Enclosed worm gear with handwheel, and where required, chain-wheel operator.
      - 3) 3. Gate Valves (Contractor's Option in lieu of Ball or Butterfly Valves):
        - a) 50 mm (2 inches) and smaller: MSS-SP 80, Bronze, 1034 kPa (150 psig), wedge disc, rising stem, union bonnet.
        - b) 65 mm (2 1/2 inches) and larger: Flanged, outside screw and yoke. MSS-SP 70, iron body, bronze mounted, 861 kPa (125 psig) wedge disc.
- E. Globe and Angle Valves
1. Globe Valves

- a. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 lb.) Globe valves shall be union bonnet with metal plug type disc.
  - b. 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-85 for globe valves.
2. Angle Valves:
- a. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 lb.) Angle valves shall be union bonnet with metal plug type disc.
  - b. 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-85 for angle.
- F. Check Valves
1. Swing Check Valves:
    - a. 50 mm (2 inches) and smaller: MSS-SP 80, bronze, 1034 kPa (150 lb.), 45 degree swing disc.
    - b. 65 mm (2 1/2 inches) and larger: 861 kPa (125 psig), flanged, iron body, bronze trim, MSS-SP-71 for check valves.
  2. Non-Slam or Silent Check Valve: Spring loaded double disc swing check or internally guided flat disc lift type check for bubble tight shut-off. Provide where check valves are shown in chilled water and hot water piping. Check valves incorporating a balancing feature may be used.
    - a. Body: MSS-SP 125 cast iron, ASTM A126, Class B, or steel, ASTM A216, Class WCB, or ductile iron, ASTM 536, flanged, grooved, or wafer type.
    - b. Seat, disc and spring: 18-8 stainless steel, or bronze, ASTM B62. Seats may be elastomer material.
- G. Water Flow Balancing Valves: For flow regulation and shut-off. Valves size shall be reduced to control valve size.
1. Ball or Globe style valve.
  2. A dual purpose flow balancing valve and adjustable flow meter, with bronze or cast iron body, calibrated position pointer, valved pressure taps or quick disconnects with integral check valves and preformed polyurethane insulating enclosure.
  3. Provide a readout kit including flow meter, readout probes, hoses, flow charts or calculator, and carrying case.

H. Automatic Balancing Control Valves: Factory calibrated to maintain constant flow (plus or minus five percent) over system pressure fluctuations of at least 10 times the minimum required for control. Provide standard pressure taps and four sets of capacity charts. Valves shall be line size and be one of the following designs:

1. Gray iron (ASTM A126) or brass body rated 1205 kPa (175 psig) at 93 degrees C (200 degrees F), with stainless steel piston and spring.
2. Brass or ferrous body designed for 2067 kPa (300 psig) service at 121 degrees C (250 degrees F), with corrosion resistant, tamper proof, self-cleaning piston/spring assembly that is easily removable for inspection or replacement.
3. Combination assemblies containing ball type shut-off valves, unions, flow regulators, strainers with blowdown valves and pressure temperature ports shall be acceptable.

**2.9 NOT USED**

**2.10 STRAINERS**

A. Y Type.

1. Screens: Bronze, monel metal or 18-8 stainless steel, free area not less than 2-1/2 times pipe area, with perforations as follows: 1.1 mm (0.045 inch) diameter perforations for 100 mm (4 inches) and larger: 3.2 mm (0.125 inch) diameter perforations.

B. not used

**2.11 NOT USED**

**2.12 NOT USED**

**2.13 NOT USED**

**2.14 NOT USED**

**2.15 NOT USED**

**2.16 PRESSURE/TEMPERATURE TEST PROVISIONS**

A. Pete's Plug: 6 mm (1/4 inch) MPT by 75 mm (3 inches) long, brass body and cap, with retained safety cap, nordel self-closing valve cores, permanently installed in piping where shown, or in lieu of pressure gage test connections shown on the drawings.

B. Provide one each of the following test items to the COR:

1. 6 mm (1/4 inch) FPT by 3 mm (1/8 inch) diameter stainless steel pressure gage adapter probe for extra long test plug. PETE'S 500 XL is an example.

2. 90 mm (3-1/2 inch) diameter, one percent accuracy, compound gage, -- 100 kPa (30 inches) Hg to 700 kPa (100 psig) range.
3. 0 - 104 degrees C (220 degrees F) pocket thermometer one-half degree accuracy, 25 mm (one inch) dial, 125 mm (5 inch) long stainless steel stem, plastic case.

**2.17 NOT USED**

**2.18 FIRESTOPPING MATERIAL**

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

**2.19 NOT USED**

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. The drawings show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment, fan-coils, coils, radiators, etc., and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories to be connected on ceiling grid. Pipe location on the drawings shall be altered by contractor where necessary to avoid interferences and clearance difficulties.
- B. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.
- C. Support piping securely. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION. Install heat exchangers at height sufficient to provide gravity flow of condensate to the flash tank and condensate pump.
- D. Install piping generally parallel to walls and column center lines, unless shown otherwise on the drawings. Space piping, including insulation, to provide 25 mm (one inch) minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope drain piping down in the direction of flow not less than 25 mm (one inch) in 12 m (40 feet). Provide eccentric reducers to keep bottom of sloped piping flat.

- E. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.
- F. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take-offs with 3-elbow swing joints where noted on the drawings.
- G. Tee water piping runouts or branches into the side of mains or other branches. Avoid bull-head tees, which are two return lines entering opposite ends of a tee and exiting out the common side.
- H. Provide manual or automatic air vent at all piping system high points and drain valves at all low points. Install piping to floor drains from all automatic air vents.
- I. Connect piping to equipment as shown on the drawings. Install components furnished by others such as:
  - 1. Water treatment pot feeders and condenser water treatment systems.
  - 2. Flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.
- J. Thermometer Wells: In pipes 65 mm (2-1/2 inches) and smaller increase the pipe size to provide free area equal to the upstream pipe area.
- K. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION.
- L. Where copper piping is connected to steel piping, provide dielectric connections.

### 3.2 PIPE JOINTS

- A. Welded: Beveling, spacing and other details shall conform to ASME B31.1 and AWS B2.1. See Welder's qualification requirements under "Quality Assurance" in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- B. Screwed: Threads shall conform to ASME B1.20; joint compound shall be applied to male threads only and joints made up so no more than three

threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.

- C. Mechanical Joint: Pipe grooving shall be in accordance with joint manufacturer's specifications. Lubricate gasket exterior including lips, pipe ends and housing interiors to prevent pinching the gasket during installation. Lubricant shall be as recommended by coupling manufacturer.
- D. 125 Pound Cast Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast iron flange.
- E. Solvent Welded Joints: As recommended by the manufacturer.

**3.3 NOT USED**

**3.4 NOT USED**

**3.5 LEAK TESTING ABOVEGROUND PIPING**

- A. Inspect all joints and connections for leaks and workmanship and make corrections as necessary, to the satisfaction of the COR. Tests may be either of those below, or a combination, as approved by the COR.
- B. An operating test at design pressure, and for hot systems, design maximum temperature.
- C. A hydrostatic test at 1.5 times design pressure. For water systems the design maximum pressure would usually be the static head, or expansion tank maximum pressure, plus pump head. Factory tested equipment (convertors, exchangers, coils, etc.) need not be field tested. Isolate equipment where necessary to avoid excessive pressure on mechanical seals and safety devices.

**3.6 NOT USED**

**3.7 NOT USED**

**3.8 NOT USED**

**3.9 OPERATING AND PERFORMANCE TEST AND INSTRUCTION**

- A. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- B. NOT USED

- - - E N D - - -



**SECTION 23 31 00**  
**HVAC DUCTS AND CASINGS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Ductwork and accessories for HVAC including the following:
  - 1. Supply air, return air, outside air, and exhaust air systems.
- B. Definitions:
  - 1. SMACNA Standards as used In this specification means the HVAC Duct Construction Standards, Metal and Flexible.
  - 2. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.
  - 3. Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
  - 4. Exposed Duct: Exposed to view in a finished room.

**1.2 RELATED WORK**

- A. Fire Stopping Material: Section 07 84 00, FIRESTOPPING.
- B. General Mechanical Requirements: Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- D. Duct Insulation: Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION
- E. NOT USED
- F. NOT USED
- G. Air Flow Control Valves and Terminal Units: Section 23 36 00, AIR TERMINAL UNITS.
- H. NOT USED
- I. NOT USED
- J. NOT USED
- K. NOT USED
- L. NOT USED
- M. Testing and Balancing of Air Flows: Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

**1.3 QUALITY ASSURANCE**

- A. Refer to article, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- B. Fire Safety Code: Comply with NFPA 90A.
- C. Duct System Construction and Installation: Referenced SMACNA Standards are the minimum acceptable quality.

- D. Duct Sealing, Air Leakage Criteria, and Air Leakage Tests: Ducts shall be sealed as per duct sealing requirements of SMACNA HVAC Air Duct Leakage Test Manual for duct pressure classes shown on the drawings.
- E. Duct accessories exposed to the air stream, such as dampers of all types (except smoke dampers) and access openings, shall be of the same material as the duct or provide at least the same level of corrosion resistance.

#### 1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Rectangular ducts:
    - a. Schedules of duct systems, materials and selected SMACNA construction alternatives for joints, sealing, gage and reinforcement.
    - b. Duct liner.
    - c. Sealants and gaskets.
    - d. Access doors.
  - 2. Round and flat oval duct construction details:
    - a. Manufacturer's details for duct fittings.
    - b. Duct liner.
    - c. Sealants and gaskets.
    - d. Access sections.
    - e. Installation instructions.
  - 3. Volume dampers, back draft dampers.
  - 4. Upper hanger attachments.
  - 5. Fire dampers, fire doors, and smoke dampers with installation instructions.
  - 6. Sound attenuators, including pressure drop and acoustic performance.
  - 7. Flexible ducts and clamps, with manufacturer's installation instructions.
  - 8. Flexible connections.
  - 9. Instrument test fittings.
  - 10 Details and design analysis of alternate or optional duct systems.
  - 11 COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- C. Coordination Drawings: Refer to article, SUBMITTALS, in Section 23 05 11

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Civil Engineers (ASCE):
  - ASCE7-05.....Minimum Design Loads for Buildings and Other Structures
- C. American Society for Testing and Materials (ASTM):
  - A167-99(2009).....Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
  - A653-09.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy coated (Galvannealed) by the Hot-Dip process
  - A1011-09a.....Standard Specification for Steel, Sheet and Strip, Hot rolled, Carbon, structural, High-Strength Low-Alloy, High Strength Low-Alloy with Improved Formability, and Ultra-High Strength
  - B209-07.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
  - C1071-05e1.....Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
  - E84-09a.....Standard Test Method for Surface Burning Characteristics of Building Materials
- D. National Fire Protection Association (NFPA):
  - 90A-09.....Standard for the Installation of Air Conditioning and Ventilating Systems
  - 96-08.....Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
- E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
  - 2nd Edition - 2005.....HVAC Duct Construction Standards, Metal and Flexible
  - 1st Edition - 1985.....HVAC Air Duct Leakage Test Manual
  - 6th Edition - 2003.....Fibrous Glass Duct Construction Standards
- F. Underwriters Laboratories, Inc. (UL):
  - 181-08.....Factory-Made Air Ducts and Air Connectors
  - 555-06 .....Standard for Fire Dampers

555S-06 .....Standard for Smoke Dampers

**PART 2 - PRODUCTS**

**2.1 DUCT MATERIALS AND SEALANTS**

- A. General: Except for systems specified otherwise, construct ducts, casings, and accessories of galvanized sheet steel, ASTM A653, coating G90; or, aluminum sheet, ASTM B209, alloy 1100, 3003 or 5052.
- B. Specified Corrosion Resistant Systems: Stainless steel sheet, ASTM A167, Class 302 or 304, Condition A (annealed) Finish No. 4 for exposed ducts and Finish No. 2B for concealed duct or ducts located in mechanical rooms.
- C. Joint Sealing: Refer to SMACNA HVAC Duct Construction Standards, paragraph S1.9.
  - 1. Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread and 50 smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer. Generally provide liquid sealant, with or without compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are not acceptable because they do not retain elasticity and bond.
  - 2. Tape: Use only tape specifically designated by the sealant manufacturer and apply only over wet sealant. Pressure sensitive tape shall not be used on bare metal or on dry sealant.
  - 3. Gaskets in Flanged Joints: Soft neoprene.
- D. Approved factory made joints may be used.

**2.2 DUCT CONSTRUCTION AND INSTALLATION**

- A. Regardless of the pressure classifications outlined in the SMACNA Standards, fabricate and seal the ductwork in accordance with the following pressure classifications:
- B. Duct Pressure Classification:
  - 0 to 50 mm (2 inch)
  - > 50 mm to 75 mm (2 inch to 3 inch)
  - > 75 mm to 100 mm (3 inch to 4 inch)Show pressure classifications on the floor plans.
- C. Seal Class: All ductwork shall receive Class A Seal
- D. Wet Air Exhaust Ducts and Accessories: Ducts for cart wash rooms shall be 1.3 mm (18 gage) stainless steel made liquid tight with continuous external weld for all seams and joints. Provide neoprene gaskets at flanged connections. Where ducts are not self draining back to the

equipment, provide low point drain pocket with copper drain pipe to sanitary sewer. Provide access door in side of duct at drain pockets.

- E. Provide a welded stainless steel duct section for housing the duct-mounted terminal humidifiers. Ductwork shall be at least 3 feet long on the upstream side and 6 feet long on the downstream side. Slope the ductwork against the direction of airflow and provide drain connections.
- F. Duct for Negative Pressure Up to 750 Pa (3 inch W.G.): Provide for exhaust duct between inlet filters and exhaust fan inlet including systems for SPD exhaust systems.
  - 1. Round Duct: Galvanized steel, spiral lock seam construction with standard slip joints.
  - 2. Rectangular Duct: Galvanized steel, minimum 1.0 mm (20 gage), Pittsburgh lock seam, companion angle joints 32 mm by 3.2 mm (1-1/4 by 1/8 inch) minimum at not more than 2.4 m (8 feet) spacing. Approved pre-manufactured joints are acceptable in lieu of companion angles.
- G. Round and Flat Oval Ducts: Furnish duct and fittings made by the same manufacturer to insure good fit of slip joints. When submitted and approved in advance, round and flat oval duct, with size converted on the basis of equal pressure drop, may be furnished in lieu of rectangular duct design shown on the drawings.
  - 1. Elbows: Diameters 80 through 200 mm (3 through 8 inches) shall be two sections die stamped, all others shall be gored construction, maximum 18 degree angle, with all seams continuously welded or standing seam. Coat galvanized areas of fittings damaged by welding with corrosion resistant aluminum paint or galvanized repair compound.
  - 2. Provide bell mouth, conical tees or taps, laterals, reducers, and other low loss fittings as shown in SMACNA HVAC Duct Construction Standards.
  - 3. Ribbed Duct Option: Lighter gage round/oval duct and fittings may be furnished provided certified tests indicating that the rigidity and performance is equivalent to SMACNA standard gage ducts are submitted.
    - a. Ducts: Manufacturer's published standard gage, G90 coating, spiral lock seam construction with an intermediate standing rib.
    - b. Fittings: May be manufacturer's standard as shown in published catalogs, fabricated by spot welding and bonding with neoprene base cement or machine formed seam in lieu of continuous welded seams.

4. Provide flat side reinforcement of oval ducts as recommended by the manufacturer and SMACNA HVAC Duct Construction Standard S3.13.

Because of high pressure loss, do not use internal tie-rod reinforcement unless approved by the COR.

H. NOT USED

I. Casings and Plenums: Construct in accordance with SMACNA HVAC Duct Construction Standards Section 6, including curbs, access doors, pipe penetrations, eliminators and drain pans. Access doors shall be hollow metal, insulated, with latches and door pulls, 500 mm (20 inches) wide by 1200 - 1350 mm (48 - 54 inches) high. Provide view port in the doors where shown. Provide drain for outside air louver plenum. Outside air plenum shall have exterior insulation. Drain piping shall be routed to the nearest floor drain.

J. Volume Dampers: Single blade or opposed blade, multi-louver type as detailed in SMACNA Standards. Refer to SMACNA Detail Figure 2-12 for Single Blade and Figure 2.13 for Multi-blade Volume Dampers.

K. Duct Hangers and Supports: Refer to SMACNA Standards Section IV. Avoid use of trapeze hangers for round duct.

### **2.3 DUCT LINER (WHERE INDICATED ON DRAWINGS)**

A. Duct sizes shown on drawings for lined duct are clear opening inside lining.

B. Duct liner is only permitted to be used for return, relief and general exhaust ducts. Duct liner is not permitted for outside air ducts, supply air ducts or any other positive pressure ductwork (provide exterior insulation only).

C. Rectangular Duct or Casing Liner: ASTM C1071, Type I (flexible), or Type II (board), 25 mm (1/2 inch) minimum thickness, applied with mechanical fasteners and 100 percent coverage of adhesive in conformance with SMACNA, Duct Liner Application Standard.

D. NOT USED

### **2.4 DUCT ACCESS DOORS, PANELS AND SECTIONS**

A. Provide access doors, sized and located for maintenance work, upstream, in the following locations:

1. Each duct mounted coil and humidifier.
2. Each fire damper (for link service), smoke damper and automatic control damper.
3. Each duct mounted smoke detector.

B. Openings shall be as large as feasible in small ducts, 300 mm by 300 mm (12 inch by 12 inch) minimum where possible. Access sections in

insulated ducts shall be double-wall, insulated. Transparent shatterproof covers are preferred for uninsulated ducts.

1. For rectangular ducts: Refer to SMACNA HVAC Duct Construction Standards (Figure 2-12).
2. For round and flat oval duct: Refer to SMACNA HVAC duct Construction Standards (Figure 2-11).

## **2.5 FIRE DAMPERS**

- A. Galvanized steel, interlocking blade type, UL listing and label, 1-1/2 hour rating, 70 degrees C (160 degrees F) fusible line, 100 percent free opening with no part of the blade stack or damper frame in the air stream.
- B. Fire dampers in wet air exhaust shall be of stainless steel construction, all others may be galvanized steel.
- C. Minimum requirements for fire dampers:
  1. The damper frame may be of design and length as to function as the mounting sleeve, thus eliminating the need for a separate sleeve, as allowed by UL 555. Otherwise provide sleeves and mounting angles, minimum 1.9 mm (14 gage), required to provide installation equivalent to the damper manufacturer's UL test installation.
  2. Submit manufacturer's installation instructions conforming to UL rating test.

## **2.6 NOT USED**

## **2.7 NOT USED**

## **2.8 FIRE DOORS**

Galvanized steel, interlocking blade type, UL listing and label, 71 degrees C (160 degrees F) fusible link, 3 hour rating and approved for openings in Class A fire walls with rating up to 4 hours, 100 percent free opening with no part of the blade stack or damper frame in the air stream.

## **2.9 FLEXIBLE AIR DUCT (FLEXIBLE AIR DUCT SHALL NOT BE USED AT THE CONNECTIONS TO THE SUPPLY AIR DIFFUSERS LOCATED IN THE OPERATING ROOM.)**

- A. General: Factory fabricated, complying with NFPA 90A for connectors not passing through floors of buildings. Flexible ducts shall not penetrate any fire or smoke barrier which is required to have a fire resistance rating of one hour or more. Flexible duct length shall not exceed 1.5 m (5 feet). Provide insulated acoustical air duct connectors in supply air duct systems and elsewhere as shown.
- B. Flexible ducts shall be listed by Underwriters Laboratories, Inc., complying with UL 181. Ducts larger than 200 mm (8 inches) in diameter

shall be Class 1. Ducts 200 mm (8 inches) in diameter and smaller may be Class 1 or Class 2.

- C. Insulated Flexible Air Duct: Factory made including mineral fiber insulation with maximum C factor of 0.25 at 24 degrees C (75 degrees F) mean temperature, encased with a low permeability moisture barrier outer jacket, having a puncture resistance of not less than 50 Beach Units. Acoustic insertion loss shall not be less than 3 dB per 300 mm (foot) of straight duct, at 500 Hz, based on 150 mm (6 inch) duct, of 750 m/min (2500 fpm).
- D. Application Criteria:
1. Temperature range: -18 to 93 degrees C (0 to 200 degrees F) internal.
  2. Maximum working velocity: 1200 m/min (4000 feet per minute).
  3. Minimum working pressure, inches of water gage: 2500 Pa (10 inches) positive, 500 Pa (2 inches) negative.
- E. Duct Clamps: 100 percent nylon strap, 80 kg (175 pounds) minimum loop tensile strength manufactured for this purpose or stainless steel strap with cadmium plated worm gear tightening device. Apply clamps with sealant and as approved for UL 181, Class 1 installation.

#### **2.10 FLEXIBLE DUCT CONNECTIONS**

Where duct connections are made to fans, air terminal units, and air handling units, install a non-combustible flexible connection of 822 g (29 ounce) neoprene coated fiberglass fabric approximately 150 mm (6 inches) wide. For connections exposed to sun and weather provide hypalon coating in lieu of neoprene. Burning characteristics shall conform to NFPA 90A. Securely fasten flexible connections to round ducts with stainless steel or zinc-coated iron draw bands with worm gear fastener. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 50 mm (2 inches) on center. Fabric shall not be stressed other than by air pressure. Allow at least 25 mm (one inch) slack to insure that no vibration is transmitted.

#### **2.11 NOT USED**

#### **2.12 NOT USED**

#### **2.13 FIRESTOPPING MATERIAL**

Refer to Section 07 84 00, FIRESTOPPING.

#### **2.14 NOT USED**

#### **2.15 NOT USED**

#### **2.16 DUCT MOUNTEDTEMPERATURE SENSOR (AIR)**

Refer to Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.



**2.17 NOT USED**

**2.18 AIR FLOW CONTROL VALVES (AFCV)**

Refer to Section 23 36 00 / 23 82 00, AIR TERMINAL UNITS / CONVECTION HEATING and COOLING UNITS.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION, particularly regarding coordination with other trades and work in existing buildings.
- B. Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards:
  - 1. Drawings show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, boxes, diffusers, grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes on the drawings are inside dimensions which shall be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.
  - 2. Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards, Section II. Provide streamliner, when an obstruction cannot be avoided and must be taken in by a duct. Repair galvanized areas with galvanizing repair compound.
  - 3. Provide bolted construction and tie-rod reinforcement in accordance with SMACNA Standards.
  - 4. Construct casings, eliminators, and pipe penetrations in accordance with SMACNA Standards, Chapter 6. Design casing access doors to swing against air pressure so that pressure helps to maintain a tight seal.
- C. Install duct hangers and supports in accordance with SMACNA Standards, Chapter 4.
- D. Install fire dampers, smoke dampers and combination fire/smoke dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test. Install fire dampers, smoke dampers and combination fire/smoke dampers at locations indicated and

- where ducts penetrate fire rated and/or smoke rated walls, shafts and where required by the COR. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges per UL and NFPA. Demonstrate re-setting of fire dampers and operation of smoke dampers to the COR.
- E. Seal openings around duct penetrations of floors and fire rated partitions with fire stop material as required by NFPA 90A.
- F. Flexible duct installation: Refer to SMACNA Standards, Chapter 3. Ducts shall be continuous, single pieces not over 1.5 m (5 feet) long (NFPA 90A), as straight and short as feasible, adequately supported. Centerline radius of bends shall be not less than two duct diameters. Make connections with clamps as recommended by SMACNA. Clamp per SMACNA with one clamp on the core duct and one on the insulation jacket. Flexible ducts shall not penetrate floors, or any chase or partition designated as a fire or smoke barrier, including corridor partitions fire rated one hour or two hour. Support ducts SMACNA Standards.
- G. Where diffusers, registers and grilles cannot be installed to avoid seeing inside the duct, paint the inside of the duct with flat black paint to reduce visibility.
- H. Control Damper Installation:
1. Provide necessary blank-off plates required to install dampers that are smaller than duct size. Provide necessary transitions required to install dampers larger than duct size.
  2. Assemble multiple sections dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.
  3. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.
  4. Install all damper control/adjustment devices on stand-offs to allow complete coverage of insulation.
- I. Air Flow Measuring Devices (AFMD): Install units with minimum straight run distances, upstream and downstream as recommended by the manufacturer.
- J. Low Pressure Duct Liner: Install in accordance with SMACNA, Duct Liner Application Standard.
- K. Protection and Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating

condition, or return to source of supply for repair or replacement, as determined by COR. Protect equipment and ducts during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting. When new ducts are connected to existing ductwork, clean both new and existing ductwork by mopping and vacuum cleaning inside and outside before operation.

### **3.2 DUCT LEAKAGE TESTS AND REPAIR**

- A. Ductwork leakage testing shall be performed by the Testing and Balancing Contractor directly contracted by the General Contractor and independent of the Sheet Metal Contractor.
- B. Ductwork leakage testing shall be performed for the entire air distribution system (including all supply, return, exhaust and relief ductwork), section by section, including fans, coils and filter sections. Based upon satisfactory initial duct leakage test results, the scope of the testing may be reduced by the COR on ductwork constructed to the 500 Pa (2" WG) duct pressure classification. In no case shall the leakage testing of ductwork constructed above the 500 Pa (2" WG) duct pressure classification or ductwork located in shafts or other inaccessible areas be eliminated.
- C. Test procedure, apparatus and report shall conform to SMACNA Leakage Test manual. The maximum leakage rate allowed is 4 percent of the design air flow rate.
- D. All ductwork shall be leak tested first before enclosed in a shaft or covered in other inaccessible areas.
- E. All tests shall be performed in the presence of the COR and the Test and Balance agency. The Test and Balance agency shall measure and record duct leakage and report to the COR and identify leakage source with excessive leakage.
- F. If any portion of the duct system tested fails to meet the permissible leakage level, the Contractor shall rectify sealing of ductwork to bring it into compliance and shall retest it until acceptable leakage is demonstrated to the COR.
- G. All tests and necessary repairs shall be completed prior to insulation or concealment of ductwork.
- H. Make sure all openings used for testing flow and temperatures by TAB Contractor are sealed properly.

### **3.3 NOT USED**

### **3.4 TESTING, ADJUSTING AND BALANCING (TAB)**

Refer to Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

**3.5 OPERATING AND PERFORMANCE TESTS**

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM  
GENERATION

- - - E N D - - -

**SECTION 23 36 00  
AIR TERMINAL UNITS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

Air terminal units, air flow control valves.

**1.2 RELATED WORK**

- A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION:  
General mechanical requirements and items, which are common to more than one section of Division 23.
- B. Section 23 31 00, HVAC DUCTS AND CASINGS: Ducts and flexible connectors.
- C. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC: Flow rates adjusting and balancing.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Air Terminal Units: Submit test data.
  - 2. Air flow control valves.
- C. Certificates:
  - 1. Compliance with paragraph, QUALITY ASSURANCE.
  - 2. Compliance with specified standards.
- D. Operation and Maintenance Manuals: Submit in accordance with paragraph, INSTRUCTIONS, in Section 01 00 00, GENERAL REQUIREMENTS.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Conditioning and Refrigeration Institute (AHRI)/(ARI):  
880-08.....Air Terminals Addendum to ARI 888-98  
incorporated into standard posted 15<sup>th</sup> December  
2002

- C. National Fire Protection Association (NFPA):  
90A-09.....Standard for the Installation of Air  
Conditioning and Ventilating Systems
- D. Underwriters Laboratories, Inc. (UL):  
181-08.....Standard for Factory-Made Air Ducts and Air  
Connectors
- E. American Society for Testing and Materials (ASTM):  
C 665-06.....Standard Specification for Mineral-Fiber  
Blanket Thermal Insulation for Light Frame  
Construction and Manufactured Housing

**1.6 GUARANTY**

In accordance with the GENERAL CONDITIONS

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Coils:
  - 1. All Variable Volume Terminals: Provide aluminum fins and copper coils for all hot water reheat coils.
  - 2. Water Heating Coils:
    - a. ARI certified, continuous plate or spiral fin type, leak tested at 2070 kPa (300 PSI).
    - b. Capacity: As indicated, based on scheduled entering water temperature.
    - c. Headers: Copper or Brass.
    - d. Fins: Aluminum
    - e. Tubes: Copper, arrange for counter-flow of heating water.
    - f. Water Flow Rate: Minimum 0.032 Liters/second (0.5 GPM).
    - g. Provide vent and drain connection at high and low point, respectively of each coil.
    - h. Coils shall be guaranteed to drain.
- B. Labeling: Control box shall be clearly marked with an identification label that lists such information as nominal CFM, maximum and minimum factory-set airflow limits, coil type and coil connection orientation, where applicable.
- C. NOT USED
- D. Dampers with internal air volume control: See section 23 31 00 HVAC DUCTS and CASINGS.

E. Terminal Sound Attenuators: See Section 23 31 00 (HVAC DUCTS AND CASINGS).

## **2.2 AIR TERMINAL UNITS (VAV BOXES)**

- A. General: Factory built, pressure independent units, field adjustable air flow rate. Clearly show on each unit the unit number and factory set air volumes corresponding to the contract drawings. Coordinate flow controller sequence and damper operation details with the drawings. All air terminal units shall be brand new products of the same manufacturer.
- B. Capacity and Performance: The Maximum Capacity of a single terminal unit shall not exceed 566 Liters/second (1,200 CFM).
- C. Sound Power Levels:  
Acoustic performance of the air terminal units shall be based on the design noise levels for the spaces stipulated in Section 23 05 41 (Noise and Vibration Control for HVAC Piping and Equipment). Equipment schedule (...) shall show the sound power levels in all octave bands. Terminal sound attenuators shall be provided, as required, to meet the intent of the design.
- D. Casing: Unit casing shall be constructed of galvanized steel no lighter than 0.85 mm (22 Gauge). Air terminal units serving the operating rooms and Cystoscopy rooms shall be fabricated without lining. Provide hanger brackets for attachment of supports.
1. Lining material: Suitable to provide required acoustic performance, thermal insulation and prevent sweating. Meet the requirements of NFPA 90A and comply with UL 181 for erosion as well as ASTM C 665 antimicrobial requirements. Insulation shall consist of 13 mm (1/2 IN) thick non-porous foil faced rigid fiberglass insulation of 4-lb/cu.ft, secured by full length galvanized steel z-strips which enclose and seal all edges. Tape and adhesives shall not be used. Materials shall be non-friable and with surfaces, including all edges, fully encapsulated and faced with perforated metal or coated so that the air stream will not detach material.
  2. Access panels (or doors): Provide panels large enough for inspection, adjustment and maintenance without disconnecting ducts, and for cleaning heating coils attached to unit, even if there are no moving parts. Panels shall be insulated to same standards as the

- rest of the casing and shall be secured and gasketed airtight. It shall require no tool other than a screwdriver to remove.
3. Total leakage from casing: Not to exceed 2 percent of the nominal capacity of the unit when subjected to a static pressure of 750 Pa (3 inch WG), with all outlets sealed shut and inlets fully open.
- E. Construct dampers and other internal devices of corrosion resisting materials which do not require lubrication or other periodic maintenance.
1. Damper Leakage: Not greater than 2 percent of maximum rated capacity, when closed against inlet static pressure of 1 kPa (4 inch WG).
- F. Provide multi-point velocity pressure sensors with external pressure taps.
1. Provide direct reading air flow rate table pasted to box.
- G. Provide static pressure tubes.
- H. Externally powered DDC variable air volume controller and damper actuator to be furnished under Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC for FIELD mounting on air terminal units. The DDC controller shall be electrically actuated.

### **2.3 AIR FLOW CONTROL VALVE**

- A. Airflow control devices shown for control of the exhaust air streams shall be the same as specified for the VAV terminals, except furnished without hot water reheat coil.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.
- B. Handle and install units in accordance with manufacturer's written instructions.
- C. Support units rigidly so they remain stationary at all times. Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and malfunction of units cannot occur.
- D. Locate air terminal units to provide a straight section of inlet duct for proper functioning of volume controls. See VA Standard Detail.



**3.2 OPERATIONAL TEST**

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM  
GENERATION.

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**SECTION 23 37 00**  
**AIR OUTLETS AND INLETS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Air Outlets and Inlets: Diffusers, Registers, and Grilles.

**1.2 RELATED WORK**

- A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- B. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

**1.3 QUALITY ASSURANCE**

- A. Refer to article, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.
- B. Fire Safety Code: Comply with NFPA 90A.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Manufacturer's Literature and Data:
  - 1. Diffusers, registers, grilles and accessories.
- C. Coordination Drawings: Refer to article, SUBMITTALS, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. Air Diffusion Council Test Code:
  - 1062 GRD-84.....Certification, Rating, and Test Manual 4<sup>th</sup> Edition
- C. American Society of Civil Engineers (ASCE):
  - ASCE7-05.....Minimum Design Loads for Buildings and Other Structures
- D. American Society for Testing and Materials (ASTM):
  - A167-99 (2004).....Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
  - B209-07.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- E. National Fire Protection Association (NFPA):
  - 90A-09.....Standard for the Installation of Air Conditioning and Ventilating Systems

F. Underwriters Laboratories, Inc. (UL):

181-08.....UL Standard for Safety Factory-Made Air Ducts  
and Connectors

**PART 2 - PRODUCTS**

**2.1 AIR OUTLETS AND INLETS**

A. Materials:

1. Steel or aluminum except that all supply air outlets installed in operating rooms and Cystoscopy rooms (see Article 2.3C.3) shall be stainless steel. Provide manufacturer's standard gasket.
2. Exposed Fastenings: The same material as the respective inlet or outlet. Fasteners for aluminum may be stainless steel.
3. Contractor shall review all ceiling drawings and details and provide all ceiling mounted devices with appropriate dimensions and trim for the specific locations.

B. Performance Test Data: In accordance with Air Diffusion Council Code 1062GRD

C. Air Supply Outlets:

1. Supply grilles: extruded aluminum Double deflection type with horizontal face bars
  - a. Margin: Flat, 30 mm (1-1/4 inches) wide.
  - b. Bar spacing: 20 mm (3/4 inch) maximum.
  - c. Finish: extruded with manufacturer's standard finish.

D. Return and Exhaust Registers and Grilles: Provide opposed blade damper without removable key operator for registers.

1. Finish: Wall units shall be extruded aluminum with manufacturer's standard aluminum finish.
2. Standard Type: Fixed horizontal face bars set at 30 to 45 degrees, approximately 30 mm (1-1/4 inch) margin.
  - a. Heavy extruded aluminum frame shall have countersunk screw mounting.
  - b. Grille shall be suitable for duct or surface mounting as indicated on drawings. All necessary appurtenances shall be provided to allow for mounting.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION, particularly regarding coordination with other trades and work in existing buildings.

B. Protection and Cleaning: Protect equipment and materials against physical damage. Place equipment in first class operating condition, or return to source of supply for repair or replacement, as determined by COR. Protect equipment during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting.

**3.2 NOT USED**

**3.3 TESTING, ADJUSTING AND BALANCING (TAB)**

Refer to Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

**3.4 OPERATING AND PERFORMANCE TESTS**

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION

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**SECTION 26 05 11**  
**REQUIREMENTS FOR ELECTRICAL INSTALLATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section applies to all sections of Division 26.
- B. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, conductors and cable, switchboards, panelboards, and other items and arrangements for the specified items are shown on the drawings.
- C. Conductor ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited.

**1.2 MINIMUM REQUIREMENTS**

- A. The International Building Code (IBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.
- B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

**1.3 TEST STANDARDS**

- A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.
- B. Definitions:
  - 1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that

- maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
  3. Certified: Materials and equipment which:
    - a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
    - b. Are periodically inspected by a NRTL.
    - c. Bear a label, tag, or other record of certification.
  4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

#### **1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)**

- A. Manufacturer's Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.
- B. Product Qualification:
  1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.
  2. The Government reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.
- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

### **1.5 APPLICABLE PUBLICATIONS**

- A. Applicable publications listed in all Sections of Division 26 are the latest issue, unless otherwise noted.
- B. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

### **1.6 MANUFACTURED PRODUCTS**

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available. Materials and equipment furnished shall be new, and shall have superior quality and freshness.
- B. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
  - 1. Components of an assembled unit need not be products of the same manufacturer.
  - 2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  - 3. Components shall be compatible with each other and with the total assembly for the intended service.
  - 4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.
- E. When Factory Tests are specified, Factory Tests shall be performed in the factory by the equipment manufacturer, and witnessed by the contractor. In addition, the following requirements shall be complied with:
  - 1. The Government shall have the option of witnessing factory tests. The Contractor shall notify the Government through the COR a minimum of thirty (30) days prior to the manufacturer's performing of the factory tests.
  - 2. When factory tests are successful, contractor shall furnish four (4) copies of the equipment manufacturer's certified test reports to the COR fourteen (14) days prior to shipment of the

equipment, and not more than ninety (90) days after completion of the factory tests.

3. When factory tests are not successful, factory tests shall be repeated in the factory by the equipment manufacturer, and witnessed by the Contractor. The Contractor shall be liable for all additional expenses for the Government to witness factory re-testing.

#### **1.7 VARIATIONS FROM CONTRACT REQUIREMENTS**

- A. Where the Government or the Contractor requests variations from the contract requirements, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

#### **1.8 MATERIALS AND EQUIPMENT PROTECTION**

- A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
  1. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
  2. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
  3. Damaged equipment shall be repaired or replaced, as determined by the COR.
  4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
  5. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

#### **1.9 WORK PERFORMANCE**

- A. All electrical work shall comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J - General Environmental Controls, OSHA Part 1910 subpart K - Medical and First Aid, and OSHA Part 1910 subpart S - Electrical, in addition to other references required by contract.



- B. Job site safety and worker safety is the responsibility of the Contractor.
- C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:
  - 1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
  - 2. Before initiating any work, a job specific work plan must be developed by the Contractor with a peer review conducted and documented by the COR and Medical Center staff. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used, and exit pathways.
  - 3. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the COR.
- D. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility.
- E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions.
- F. Coordinate location of equipment and conduit with other trades to minimize interference.

#### **1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS**

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Working clearances shall not be less than specified in the NEC.
- C. Inaccessible Equipment:
  - 1. Where the Government determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
  - 2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use

of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

#### **1.11 EQUIPMENT IDENTIFICATION**

- A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.
- B. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.
- C. Install adhesive arc flash warning labels on all equipment as required by NFPA 70E. Label shall show specific and correct information for specific equipment based on its arc flash calculations. Label shall show the followings:
  - 1. Nominal system voltage.
  - 2. Arc flash boundary (inches).
  - 3. Available arc flash incident energy at the corresponding working distance (calories/cm<sup>2</sup>).
  - 4. Required PPE category and description.
  - 5. limited approach distance (inches), restricted approach distance (inches).
  - 6. Equipment/bus name, date prepared, and manufacturer name and address.

#### **1.12 SUBMITTALS**

- A. Submit to the COR in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

- B. The Government's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.
- C. All submittals shall include six copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Government to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.
- D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
1. Mark the submittals, "SUBMITTED UNDER SECTION\_\_\_\_\_".
  2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
  3. Submit each section separately.
- E. The submittals shall include the following:
1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.
  2. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
  3. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.
- F. Maintenance and Operation Manuals:
1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
  2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names,

- addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.
3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
  4. The manuals shall include:
    - a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
    - b. A control sequence describing start-up, operation, and shutdown.
    - c. Description of the function of each principal item of equipment.
    - d. Installation instructions.
    - e. Safety precautions for operation and maintenance.
    - f. Diagrams and illustrations.
    - g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
    - h. Performance data.
    - i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
    - j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.
- G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.
- H. After approval and prior to installation, furnish the COR with one sample of each of the following:
1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
  2. Each type of conduit coupling, bushing, and termination fitting.
  3. Conduit hangers, clamps, and supports.
  4. Duct sealing compound.

5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

**1.13 SINGULAR NUMBER**

- A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

**1.14 ACCEPTANCE CHECKS AND TESTS**

- A. The Contractor shall furnish the instruments, materials, and labor for tests.
- B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer's representatives and technicians so that a complete, functional, and operational system is delivered to the Government.
- C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests. Repair, replacement, and retesting shall be accomplished at no additional cost to the Government.

**1.15 WARRANTY**

- A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer for the Government.

**1.16 INSTRUCTION**

- A. Instruction to designated Government personnel shall be provided for the particular equipment or system as required in each associated technical specification section.
- B. Furnish the services of competent instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be trained in operating theory as well as practical operation and maintenance procedures.

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C. A training schedule shall be developed and submitted by the Contractor  
and approved by the COR at least 30 days prior to the planned training.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

---END---

**SECTION 26 05 19**  
**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of the electrical conductors and cables for use in electrical systems rated 600 V and below, indicated as cable(s), conductor(s), wire, or wiring in this section.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:  
Requirements that apply to all sections of Division 26.
- B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:  
Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for conductors and cables.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 FACTORY TESTS**

- A. Conductors and cables shall be thoroughly tested at the factory per NEMA to ensure that there are no electrical defects. Factory tests shall be certified.

**1.5 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Submit the following data for approval:
      - 1) Electrical ratings and insulation type for each conductor and cable.
      - 2) Splicing materials and pulling lubricant.
  2. Certifications: Two weeks prior to final inspection, submit the following.
    - a. Certification by the manufacturer that the conductors and cables conform to the requirements of the drawings and specifications.

- b. Certification by the Contractor that the conductors and cables have been properly installed, adjusted, and tested.

**1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.
- B. American Society of Testing Material (ASTM):
  - D2301-10.....Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape
  - D2304-10.....Test Method for Thermal Endurance of Rigid Electrical Insulating Materials
  - D3005-10.....Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape
- C. National Electrical Manufacturers Association (NEMA):
  - WC 70-09.....Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy
- D. National Fire Protection Association (NFPA):
  - 70-11.....National Electrical Code (NEC)
- E. Underwriters Laboratories, Inc. (UL):
  - 44-10.....Thermoset-Insulated Wires and Cables
  - 83-08.....Thermoplastic-Insulated Wires and Cables
  - 467-07.....Grounding and Bonding Equipment
  - 486A-486B-03.....Wire Connectors
  - 486C-04.....Splicing Wire Connectors
  - 486D-05.....Sealed Wire Connector Systems
  - 486E-09.....Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
  - 493-07.....Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables
  - 514B-04.....Conduit, Tubing, and Cable Fittings

**PART 2 - PRODUCTS**

**2.1 CONDUCTORS AND CABLES**

- A. Conductors and cables shall be in accordance with NEMA, UL, as specified herein, and as shown on the drawings.
- B. All conductors shall be copper.



C. Single Conductor and Cable:

1. No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.
2. No. 8 AWG and larger: Stranded.
3. No. 10 AWG and smaller: Solid; except shall be stranded for final connection to motors, transformers, and vibrating equipment.
4. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

D. Color Code:

1. No. 10 AWG and smaller: Solid color insulation or solid color coating.
2. No. 8 AWG and larger: Color-coded using one of the following methods:
  - a. Solid color insulation or solid color coating.
  - b. Stripes, bands, or hash marks of color specified.
  - c. Color using 19 mm (0.75 inches) wide tape.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
5. Conductors shall be color-coded as follows:

208/120 V	Phase	480/277 V
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

6. Lighting circuit "switch legs", and 3-way and 4-way switch "traveling wires," shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Coordinate color coding in the field with the COR.

**2.2 SPLICES**

- A. Splices shall be in accordance with NEC and UL.
- B. Above Ground Splices for No. 10 AWG and Smaller:
  1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.

2. The integral insulator shall have a skirt to completely cover the stripped conductors.
  3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.
- C. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:
1. Compression, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
  2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
  3. Splice and insulation shall be product of the same manufacturer.
  4. All bolts, nuts, and washers used with splices shall be zinc-plated steel.
- D. Above Ground Splices for 250 kcmil and Larger:
1. Long barrel "butt-splice" or "sleeve" type compression connectors, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
  2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
  3. Splice and insulation shall be product of the same manufacturer.
- E. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

### **2.3 CONNECTORS AND TERMINATIONS**

- A. Mechanical type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
- B. Long barrel compression type of high conductivity and corrosion-resistant material, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
- C. All bolts, nuts, and washers used to connect connections and terminations to bus bars or other termination points shall be zinc-plated steel.

## **2.4 CONTROL WIRING**

- A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG.
- B. Control wiring shall be sized such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

## **2.5 WIRE LUBRICATING COMPOUND**

- A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Install conductors in accordance with the NEC, as specified, and as shown on the drawings.
- B. Install all conductors in raceway systems.
- C. Splice conductors only in outlet boxes, junction boxes, pullboxes, manholes, or handholes.
- D. Conductors of different systems (e.g., 120 V and 277 V) shall not be installed in the same raceway.
- E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.
- F. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic ties.
- G. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.
- H. Use expanding foam or non-hardening duct-seal to seal conduits entering a building, after installation of conductors.
- I. Conductor and Cable Pulling:
  - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
  - 2. Use nonmetallic pull ropes.
  - 3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.
  - 4. All conductors in a single conduit shall be pulled simultaneously.

5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

J. No more than three branch circuits shall be installed in any one conduit.

K. When stripping stranded conductors, use a tool that does not damage the conductor or remove conductor strands.

### **3.2 SPLICE AND TERMINATION INSTALLATION**

A. Splices and terminations shall be mechanically and electrically secure, and tightened to manufacturer's published torque values using a torque screwdriver or wrench.

B. Where the Government determines that unsatisfactory splices or terminations have been installed, replace the splices or terminations at no additional cost to the Government.

### **3.3 CONDUCTOR IDENTIFICATION**

A. When using colored tape to identify phase, neutral, and ground conductors larger than No. 8 AWG, apply tape in half-overlapping turns for a minimum of 75 mm (3 inches) from terminal points, and in junction boxes, pullboxes, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.

### **3.4 FEEDER CONDUCTOR IDENTIFICATION**

A. In each interior pullbox and each underground manhole and handhole, install brass tags on all feeder conductors to clearly designate their circuit identification and voltage. The tags shall be the embossed type, 40 mm (1-1/2 inches) in diameter and 40 mils thick. Attach tags with plastic ties.

### **3.5 EXISTING CONDUCTORS**

A. Unless specifically indicated on the plans, existing conductors shall not be reused.

### **3.6 CONTROL WIRING INSTALLATION**

A. Unless otherwise specified in other sections, install control wiring and connect to equipment to perform the required functions as specified or as shown on the drawings.

B. Install a separate power supply circuit for each system, except where otherwise shown on the drawings.

### **3.7 CONTROL WIRING IDENTIFICATION**

A. Install a permanent wire marker on each wire at each termination.

- B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
- C. Wire markers shall retain their markings after cleaning.

### **3.8 ACCEPTANCE CHECKS AND TESTS**

- A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
  - 1. Visual Inspection and Tests: Inspect physical condition.
  - 2. Electrical tests:
    - a. After installation but before connection to utilization devices, such as fixtures, motors, or appliances, test conductors phase-to-phase and phase-to-ground resistance with an insulation resistance tester. Existing conductors to be reused shall also be tested.
    - b. Applied voltage shall be 500 V DC for 300 V rated cable, and 1000 V DC for 600 V rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300 V rated cable and 100 megohms for 600 V rated cable.
    - c. Perform phase rotation test on all three-phase circuits.

---END---

**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.
- B. "Grounding electrode system" refers to grounding electrode conductors and all electrodes required or allowed by NEC, as well as made, supplementary, and lightning protection system grounding electrodes.
- C. The terms "connect" and "bond" are used interchangeably in this section and have the same meaning.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:  
Requirements that apply to all sections of Division 26.
- B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES:  
Low-voltage conductors.
- C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
  - 1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Submit plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.
  - 2. Test Reports:
    - a. Two weeks prior to the final inspection, submit ground resistance field test reports to the COR.
  - 3. Certifications:
    - a. Certification by the Contractor that the grounding equipment has been properly installed and tested.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American Society for Testing and Materials (ASTM):
  - B1-07.....Standard Specification for Hard-Drawn Copper Wire
  - B3-07.....Standard Specification for Soft or Annealed Copper Wire
  - B8-11.....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - 81-83.....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements
- D. National Fire Protection Association (NFPA):
  - 70-11.....National Electrical Code (NEC)
  - 70E-12.....National Electrical Safety Code
  - 99-12.....Health Care Facilities
- E. Underwriters Laboratories, Inc. (UL):
  - 44-10 .....Thermoset-Insulated Wires and Cables
  - 83-08 .....Thermoplastic-Insulated Wires and Cables
  - 467-07 .....Grounding and Bonding Equipment

**PART 2 - PRODUCTS**

**2.1 GROUNDING AND BONDING CONDUCTORS**

- A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.
- B. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be bare solid copper. Bonding conductors shall be stranded for final connection to motors, transformers, and vibrating equipment.

C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

D. Insulation: THHN-THWN and XHHW-2.

## **2.2 GROUND CONNECTIONS**

A. Above Grade:

1. Connection to Grounding Bus Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Install grounding equipment in accordance with the NEC, as shown on the drawings, and as specified herein.
- B. Equipment Grounding: Metallic piping, building structural steel, electrical enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

### **3.2 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS**

- A. Panelboards and other electrical equipment:
  1. Connect the equipment grounding conductors to the ground bus.
  2. Connect metallic conduits by grounding bushings and equipment grounding conductor to the equipment ground bus.

### **3.3 RACEWAY**

- A. Conduit Systems:
  1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
  2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
  3. Metallic conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
  4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect



- bushings with a equipment grounding conductor to the equipment ground bus.
- B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and power and lighting branch circuits.
- C. Boxes, Cabinets, Enclosures, and Panelboards:
1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
  2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
- D. Wireway Systems:
1. Bond the metallic structures of wireway to provide electrical continuity throughout the wireway system, by connecting a No. 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.
  2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).
  3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.
  4. Use insulated No. 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 M (49 feet).
- E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.
- F. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.
- G. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

**3.4 CORROSION INHIBITORS**

- A. When making grounding and bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

---END---

**SECTION 26 05 33**  
**RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
  - 1. Shop Drawings:
    - a. Size and location of main feeders.
    - b. Size and location of panels and pull-boxes.
    - c. Layout of required conduit penetrations through structural elements.
    - d. Submit the following data for approval:
      - 1) Raceway types and sizes.
      - 2) Conduit bodies, connectors and fittings.
      - 3) Junction and pull boxes, types and sizes.
  - 2. Certifications: Two weeks prior to final inspection, submit the following:
    - a. Certification by the manufacturer that raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment conform to the requirements of the drawings and specifications.

- b. Certification by the Contractor that raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment have been properly installed.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American National Standards Institute (ANSI):
  - C80.1-05.....Electrical Rigid Steel Conduit
  - C80.3-05.....Steel Electrical Metal Tubing
  - C80.6-05.....Electrical Intermediate Metal Conduit
- C. National Fire Protection Association (NFPA):
  - 70-11.....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
  - 1-05.....Flexible Metal Conduit
  - 5-11.....Surface Metal Raceway and Fittings
  - 6-07.....Electrical Rigid Metal Conduit - Steel
  - 50-95.....Enclosures for Electrical Equipment
  - 360-13.....Liquid-Tight Flexible Steel Conduit
  - 467-13.....Grounding and Bonding Equipment
  - 514A-13.....Metallic Outlet Boxes
  - 514B-12.....Conduit, Tubing, and Cable Fittings
  - 514C-07.....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
  - 651-11.....Schedule 40 and 80 Rigid PVC Conduit and Fittings
  - 651A-11.....Type EB and A Rigid PVC Conduit and HDPE Conduit
  - 797-07.....Electrical Metallic Tubing
  - 1242-06.....Electrical Intermediate Metal Conduit - Steel
- E. National Electrical Manufacturers Association (NEMA):
  - TC-2-13.....Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
  - TC-3-13.....PVC Fittings for Use with Rigid PVC Conduit and Tubing
  - FB1-12.....Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
  - FB2.10-13.....Selection and Installation Guidelines for Fittings for use with Non-Flexible Conduit or

Tubing (Rigid Metal Conduit, Intermediate  
Metallic Conduit, and Electrical Metallic  
Tubing)

FB2.20-12.....Selection and Installation Guidelines for  
Fittings for use with Flexible Electrical  
Conduit and Cable

F. American Iron and Steel Institute (AISI):

S100-2007.....North American Specification for the Design of  
Cold-Formed Steel Structural Members

## **ART 2 - PRODUCTS**

### **2.1 MATERIAL**

A. Conduit Size: In accordance with the NEC, but not less than 0.5 in [13 mm] unless otherwise shown. Where permitted by the NEC, 0.5 in [13 mm] flexible conduit may be used for tap connections to recessed lighting fixtures.

B. Conduit:

1. Size: In accordance with the NEC, but not less than 13 mm (0.5-inch).

2. Rigid Steel Conduit (RMC): Shall conform to UL 6 and ANSI C80.1.

3. Rigid aluminum: Not applicable.

4. Rigid Intermediate Steel Conduit (IMC): Shall conform to UL 1242 and ANSI C80.6.

5. Electrical Metallic Tubing (EMT): Shall conform to UL 797 and ANSI C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 V or less.

6. Flexible Metal Conduit: Shall conform to UL 1.

7. Liquid-tight Flexible Metal Conduit: Shall conform to UL 360.

8. Direct Burial Plastic Conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).

9. Surface Metal Raceway: Shall conform to UL 5.

C. Conduit Fittings:

1. Rigid steel and IMC conduit fittings:

a. Fittings shall meet the requirements of UL 514B and NEMA FB1.

b. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.

c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.

- d. Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
  - e. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
  - f. Sealing fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
2. Electrical metallic tubing fittings:
- a. Fittings and conduit bodies shall meet the requirements of UL 514B, ANSI C80.3, and NEMA FB1.
  - b. Only steel or malleable iron materials are acceptable.
  - c. Compression couplings and connectors: Concrete-tight and rain-tight, with connectors having insulated throats.
  - d. Indent-type connectors or couplings are prohibited.
  - e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
4. Flexible steel conduit fittings:
- a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
  - b. Clamp-type, with insulated throat.
5. Liquid-tight flexible metal conduit fittings:
- a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
  - b. Only steel or malleable iron materials are acceptable.
  - c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
6. Surface metal raceway fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.
7. Expansion and deflection couplings:
- a. Conform to UL 467 and UL 514B.

- b. Accommodate a 0.75 in [19 mm] deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
  - c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.
  - d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.
- D. Conduit Supports:
- 1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
  - 2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
  - 3. Multiple conduit (trapeze) hangers: Not less than 1.5 x 1.5 in [38 mm x 38 mm], 12-gauge steel, cold-formed, lipped channels; with not less than 0.375 in [9 mm] diameter steel hanger rods.
  - 4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.
- E. Outlet, Junction, and Pull Boxes:
- 1. UL-50 and UL-514A.
  - 2. Rustproof cast metal where required by the NEC or shown on drawings.
  - 3. Sheet metal boxes: Galvanized steel, except where otherwise shown.
  - 4. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.
- F. Wireways: Equip with hinged covers, except where removable covers are shown. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

### **PART 3 - EXECUTION**

#### **3.1 PENETRATIONS**

- A. Cutting or Holes:
- 1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the COR prior to drilling through structural elements.

2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except where permitted by COR as required by limited working space.
- B. Firestop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases.
- C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight, as specified in Section 07 92 00, JOINT SEALANTS.

### **3.2 INSTALLATION, GENERAL**

- A. In accordance with UL, NEC, NEMA, as shown on drawings, and as specified herein.
- B. Raceway systems used for Essential Electrical Systems (EES) shall be entirely independent of other raceway systems.
- C. Install conduit as follows:
  1. In complete mechanically and electrically continuous runs before pulling in cables or wires.
  2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
  3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new conduits.
  4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
  5. Cut conduits square, ream, remove burrs, and draw up tight.
  6. Independently support conduit at 2.4 M (8 feet) on centers with specified materials and as shown on drawings.
  7. Do not use suspended ceilings, suspended ceiling supporting members, lighting fixtures, other conduits, cable tray, boxes, piping, or ducts to support conduits and conduit runs.
  8. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.
  9. Close ends of empty conduits with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
  10. Conduit installations under fume and vent hoods are prohibited.
  11. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid steel and IMC conduit



installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.

12. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.

13. Conduit bodies shall only be used for changes in direction, and shall not contain splices.

D. Layout and Homeruns:

1. Install conduit with wiring, including homeruns, as shown on drawings.

2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the COR.

**3.3 CONCEALED WORK INSTALLATION**

A. Above Furred or Suspended Ceilings and in Walls:

1. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits in the same system is prohibited.

3. Align and run conduit parallel or perpendicular to the building lines.

4. Connect recessed lighting fixtures to conduit runs with maximum 1.8 M (6 feet) of flexible metal conduit extending from a junction box to the fixture.

5. Tightening set screws with pliers is prohibited.

6. For conduits running through metal studs, limit field cut holes to no more than 70% of web depth. Spacing between holes shall be at least 457 mm (18 inches). Cuts or notches in flanges or return lips shall not be permitted.

**3.4 EXPOSED WORK INSTALLATION**

A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.

B. Conduit for Conductors above 600 V: Rigid steel. Mixing different types of conduits indiscriminately in the system is prohibited.

C. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the system is prohibited.

D. Align and run conduit parallel or perpendicular to the building lines.

E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.

- F. Support horizontal or vertical runs at not over 8 ft [2.4 M] intervals.
- G. Surface metal raceways: Use only where shown.

### **3.5 WET OR DAMP LOCATIONS**

- A. Use rigid steel or IMC conduits unless as shown on drawings.
- B. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.
- C. Use rigid steel or IMC conduit within 1.5 M (5 feet) of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers, unless as shown on drawings. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating
- D. Conduits run on roof shall be supported with integral galvanized lipped steel channel, attached to UV-inhibited polycarbonate or polypropylene blocks every 2.4 M (8 feet) with 9 mm (3/8-inch) galvanized threaded rods, square washer and locknut

### **3.6 MOTORS AND VIBRATING EQUIPMENT**

- A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.
- B. Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water. Provide a green equipment grounding conductor with flexible metal conduit.
- C. Provide a green equipment grounding conductor with flexible and liquid-tight flexible metal conduit.

### **3.7 EXPANSION JOINTS**

- A. Conduits 3 in [75 mm] and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 75 mm (3 inch) with junction boxes on both sides of the expansion joint. Connect flexible metal conduits to junction boxes with sufficient slack to produce a 125 mm (5 inch) vertical drop midway between the ends of the flexible metal conduit.

Flexible metal conduit shall have a green insulated copper bonding jumper installed. In lieu of this flexible metal conduit, expansion and deflection couplings as specified above are acceptable.

C. Install expansion and deflection couplings where shown.

### **3.8 CONDUIT SUPPORTS, INSTALLATION**

- A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 200 lbs [90 kg]. Attach each conduit with U-bolts or other approved fasteners.
- D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
  - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
  - 2. Existing Construction:
    - a. Steel expansion anchors not less than 0.25 in [6 mm] bolt size and not less than 1.125 in [28 mm] embedment.
    - b. Power set fasteners not less than 0.25 in [6 mm] diameter with depth of penetration not less than 3 in [75 mm].
    - c. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts.
- G. Bolts supported only by plaster or gypsum wallboard are not acceptable.
- H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- K. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.
- L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for

cable and wire with fittings that include internal wedges and retaining collars.

### 3.9 BOX INSTALLATION

- A. Boxes for Concealed Conduits:
  - 1. Flush-mounted.
  - 2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations or where more than the equivalent of 4-90 degree bends are necessary.
- C. Locate pullboxes so that covers are accessible and easily removed. Coordinate locations with piping and ductwork where installed above ceilings.
- D. Remove only knockouts as required. Plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
- E. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 600 mm (24 inch) center-to-center lateral spacing shall be maintained between boxes.
- F. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.
- G. Minimum size of outlet boxes for ground fault circuit interrupter (GFCI) receptacles is 100 mm (4 inches) square x 55 mm (2.125 inches) deep, with device covers for the wall material and thickness involved.
- H. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1."
- I. On all branch circuit junction box covers, identify the circuits with black marker.

- - - E N D - - -

**SECTION 26 24 16**  
**PANELBOARDS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of panelboards.

**1.2 RELATED WORK**

- A. Section 09 91 00, PAINTING: Painting of panelboards.
- B. Not applicable.
- C. Not applicable.
- D. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:  
Requirements that apply to all sections of Division 26.
- E. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES:  
Low-voltage conductors.
- F. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:  
Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- G. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.
- H. Not applicable.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
  - 1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, circuit breakers, wiring and connection diagrams, accessories, and nameplate data.
  - 2. Manuals:
    - a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering circuit breakers and replacement parts.

- 1) Include schematic diagrams, with all terminals identified, matching terminal identification in the panelboards.
- 2) Include information for testing, repair, troubleshooting, assembly, and disassembly.
- b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following.
  - a. Certification by the manufacturer that the panelboards conform to the requirements of the drawings and specifications.
  - b. Certification by the Contractor that the panelboards have been properly installed, adjusted, and tested.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. International Code Council (ICC):  
IBC-12.....International Building Code
- C. National Electrical Manufacturers Association (NEMA):  
PB 1-11.....Panelboards  
250-08.....Enclosures for Electrical Equipment (1,000V  
Maximum)
- D. National Fire Protection Association (NFPA):  
70-11.....National Electrical Code (NEC)  
70E-12.....Standard for Electrical Safety in the Workplace
- E. Underwriters Laboratories, Inc. (UL):  
50-95.....Enclosures for Electrical Equipment  
67-09.....Panelboards  
489-09.....Molded Case Circuit Breakers and Circuit  
Breaker Enclosures

**PART 2 - PRODUCTS**

**2.1 GENERAL REQUIREMENTS**

- A. Panelboards shall be in accordance with NEC, NEMA, UL, as specified, and as shown on the drawings.

- B. Panelboards shall have main breaker or main lugs, bus size, voltage, phases, number of circuit breaker mounting spaces, top or bottom feed, flush or surface mounting, branch circuit breakers, and accessories as shown on the drawings.
- C. Panelboards shall be completely factory-assembled with molded case circuit breakers and integral accessories as shown on the drawings or specified herein.
- D. Non-reduced size copper bus bars, rigidly supported on molded insulators, and fabricated for bolt-on type circuit breakers.
- E. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type.
- F. Mechanical lugs furnished with panelboards shall be cast, stamped, or machined metal alloys listed for use with the conductors to which they will be connected.
- G. Neutral bus shall be 100% rated, mounted on insulated supports.
- H. Grounding bus bar shall be equipped with screws or lugs for the connection of equipment grounding conductors.
- I. Bus bars shall be braced for the available short-circuit current as shown on the drawings, but not be less than 10,000 A symmetrical for 120/208 V and 120/240 V panelboards, and 14,000 A symmetrical for 277/480 V panelboards.
- J. In two-section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side of main lugs only, or through-feed lugs for main breaker type panelboards, and have field-installed cable connections to the second section as shown on the drawings. Panelboard sections with tapped bus or crossover bus are not acceptable.
- K. Series-rated panelboards are not permitted.

## **2.2 ENCLOSURES AND TRIMS**

- A. Enclosures:
  - 1. Provide galvanized steel enclosures, with NEMA rating as shown on the drawings or as required for the environmental conditions in which installed.
  - 2. Enclosures shall not have ventilating openings.
  - 3. Enclosures may be of one-piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.

4. Provide manufacturer's standard option for prepunched knockouts on top and bottom endwalls.
5. Include removable inner dead front cover, independent of the panelboard cover.

B. Trims:

1. Hinged "door-in-door" type.
2. Interior hinged door with hand-operated latch or latches, as required to provide access only to circuit breaker operating handles, not to energized parts.
3. Outer hinged door shall be securely mounted to the panelboard enclosure with factory bolts, screws, clips, or other fasteners, requiring a key or tool for entry. Hand-operated latches are not acceptable.
4. Inner and outer doors shall open left to right.
5. Trims shall be flush or surface type as shown on the drawings.

**2.3 MOLDED CASE CIRCUIT BREAKERS**

- A. Circuit breakers shall be per UL, NEC, as shown on the drawings, and as specified.
- B. Circuit breakers shall be bolt-on type.
- C. Circuit breakers shall have minimum interrupting rating as required to withstand the available fault current, but not less than:
  1. 120/208 V Panelboard: 10,000 A symmetrical.
  2. 120/240 V Panelboard: 10,000 A symmetrical.
  3. 277/480 V Panelboard: 14,000 A symmetrical.
- D. Circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for less than 400 A frame. Circuit breakers with 400 A frames and above shall have magnetic trip, adjustable from 5x to 10x.
- E. Circuit breaker features shall be as follows:
  1. A rugged, integral housing of molded insulating material.
  2. Silver alloy contacts.
  3. Arc quenchers and phase barriers for each pole.
  4. Quick-make, quick-break, operating mechanisms.
  5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
  6. Electrically and mechanically trip free.



7. An operating handle which indicates closed, tripped, and open positions.
8. An overload on one pole of a multi-pole breaker shall automatically cause all the poles of the breaker to open.
9. Ground fault current interrupting breakers, shunt trip breakers, lighting control breakers (including accessories to switch line currents), or other accessory devices or functions shall be provided where shown on the drawings.
10. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory accordingly.

#### **2.4 NOT USED**

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Installation shall be in accordance with the manufacturer's instructions, the NEC, as shown on the drawings, and as specified.
- B. Locate panelboards so that the present and future conduits can be conveniently connected.
- C. Not applicable
- D. Install a printed schedule of circuits in each panelboard after approval by the Resident Engineer. Schedules shall reflect final load descriptions, room numbers, and room names connected to each circuit breaker. Schedules shall be printed on the panelboard directory cards and be installed in the appropriate panelboards
- E. Mount panelboards such that the maximum height of the top circuit breaker above the finished floor shall not exceed 1980 mm (78 inches).
- F. Provide blank cover for each unused circuit breaker mounting space.
- G. Not applicable.
- H. Rust and scale shall be removed from the inside of existing enclosures where new interior components are to be installed. Paint inside of enclosures with rust-preventive paint before the new interior components are installed. Provide new trim. Trim shall fit tight to the enclosure.

- I. Panelboard enclosures shall not be used for conductors feeding through, spliced, or tapping off to other enclosures or devices.

### **3.2 ACCEPTANCE CHECKS AND TESTS**

- A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
  1. Visual Inspection and Tests:
    - a. Compare equipment nameplate data with specifications and approved shop drawings.
    - b. Inspect physical, electrical, and mechanical condition.
    - c. Verify appropriate anchorage and required area clearances.
    - d. Verify that circuit breaker sizes and types correspond to approved shop drawings.
    - e. To verify tightness of accessible bolted electrical connections, use the calibrated torque-wrench method or perform thermographic survey after energization.
    - f. Vacuum-clean enclosure interior. Clean enclosure exterior.

### **3.3 FOLLOW-UP VERIFICATION**

- A. Upon completion of acceptance checks, settings, and tests, the Contractor shall demonstrate that the panelboards are in good operating condition and properly performing the intended function.

---END---

**SECTION 26 27 26**  
**WIRING DEVICES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of wiring devices.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.
- B. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.
- C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Conductors and Cables.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Include electrical ratings, dimensions, mounting details, construction materials, grade, and termination information.
  2. Manuals:
    - a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and information for ordering replacement parts.
    - b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certifications: Two weeks prior to final inspection, submit the following.
  - a. Certification by the manufacturer that the wiring devices conform to the requirements of the drawings and specifications.
  - b. Certification by the Contractor that the wiring devices have been properly installed and adjusted.

#### **1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. National Fire Protection Association (NFPA):
  - 70-11.....National Electrical Code (NEC)
  - 99-12.....Health Care Facilities
- C. National Electrical Manufacturers Association (NEMA):
  - WD 1-10.....General Color Requirements for Wiring Devices
  - WD 6-08 .....Wiring Devices - Dimensional Specifications
- D. Underwriter's Laboratories, Inc. (UL):
  - 5-11.....Surface Metal Raceways and Fittings
  - 20-10.....General-Use Snap Switches
  - 231-07.....Power Outlets
  - 467-07.....Grounding and Bonding Equipment
  - 498-07.....Attachment Plugs and Receptacles
  - 943-11.....Ground-Fault Circuit-Interrupters
  - 1449-07.....Surge Protective Devices
  - 1472-96.....Solid State Dimming Controls

### **PART 2 - PRODUCTS**

#### **2.1 RECEPTACLES**

- A. General: All receptacles shall comply with NEMA, NFPA, UL, and as shown on the drawings.
  1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.
  2. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four minimum) and side wiring from four captively held binding screws.

- B. Duplex Receptacles: Hospital-grade, single phase, 20 ampere, 120 volts, 2-pole, 3-wire, NEMA 5-20R, with break-off feature for two-circuit operation.
1. Bodies shall be gray in color.
  2. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit, hospital-grade, suitable for mounting in a standard outlet box, with end-of-life indication and provisions to isolate the face due to improper wiring.
    - a. Ground fault interrupter shall be consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. Device shall have nominal sensitivity to ground leakage current of 4-6 milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or - 1 milliampere) on the load side of the device. Device shall have a minimum nominal tripping time of 0.025 second.
- C. Receptacles; 20, 30, and 50 ampere, 250 Volts: Shall be complete with appropriate cord grip plug.
- D. Weatherproof Receptacles: Shall consist of a duplex receptacle, mounted in box with a gasketed, weatherproof, cast metal cover plate and cap over each receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.

## **2.2 TOGGLE SWITCHES**

- A. Toggle switches shall be totally enclosed tumbler type with nylon bodies. Handles shall be gray in color unless otherwise specified or shown on the drawings.
1. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plasters ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.
  2. Switches shall be rated 20 amperes at 120-277 Volts AC.

### **2.3 WALL PLATES**

- A. Wall plates for switches and receptacles shall be type 302 stainless steel. Oversize plates are not acceptable.
- C. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Installation shall be in accordance with the NEC and as shown as on the drawings.
- B. Install wiring devices after wall construction and painting is complete.
- C. The ground terminal of each wiring device shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the branch circuit equipment grounding conductor.
- D. Outlet boxes for toggle switches shall be mounted on the strike side of doors.
- E. Provide barriers in multigang outlet boxes to comply with the NEC.
- F. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material.
- G. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the Contractor shall coordinate exact field location of the above items with other trades.
- H. Install wall switches with the toggle OFF position down.
- I. Install specific-use receptacles at heights shown on the drawings.
- J. Install vertically mounted receptacles with the ground pin up. Install horizontally mounted receptacles with the ground pin to the right.
- K. When required or recommended by the manufacturer, use a torque screwdriver. Tighten unused terminal screws.
- L. Label device plates with a permanent adhesive label listing panel and circuit feeding the wiring device.

### **3.2 ACCEPTANCE CHECKS AND TESTS**

- A. Perform manufacturer's required field checks in accordance with the manufacturer's recommendations. In addition, include the following:
  - 1. Visual Inspection and Tests:

- a. Inspect physical and electrical condition.
- b. Vacuum-clean surface metal raceway interior. Clean metal raceway exterior.
- c. Test wiring devices for damaged conductors, high circuit resistance, poor connections, inadequate fault current path, defective devices, or similar problems using a portable receptacle tester. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.
- d. Test GFCI receptacles.

---END---

**SECTION 26 29 21**  
**ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of fused and unfused disconnect switches (indicated as switches in this section), and separately-enclosed circuit breakers for use in electrical systems rated 600 V and below.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:  
Requirements that apply to all sections of Division 26.
- B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES:  
Low-voltage conductors.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:  
Requirements for personnel safety and to provide a low impedance path for possible ground faults.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Submit the following data for approval:
      - 1) Electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, fuses, circuit breakers, wiring and connection diagrams, accessories, and device nameplate data.
  2. Manuals:
    - a. Submit complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering fuses, circuit breakers, and replacement parts.



- 1) Include schematic diagrams, with all terminals identified, matching terminal identification in the enclosed switches and circuit breakers.
- 2) Include information for testing, repair, troubleshooting, assembly, and disassembly.
- b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following.
  - a. Certification by the manufacturer that the enclosed switches and circuit breakers conform to the requirements of the drawings and specifications.
  - b. Certification by the Contractor that the enclosed switches and circuit breakers have been properly installed, adjusted, and tested.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. International Code Council (ICC):  
IBC-12.....International Building Code
- C. National Electrical Manufacturers Association (NEMA):  
FU 1-07.....Low Voltage Cartridge Fuses  
KS 1-06.....Enclosed and Miscellaneous Distribution  
Equipment Switches (600 Volts Maximum)
- D. National Fire Protection Association (NFPA):  
70-11.....National Electrical Code (NEC)
- E. Underwriters Laboratories, Inc. (UL):  
98-07.....Enclosed and Dead-Front Switches  
248-00.....Low Voltage Fuses  
489-09.....Molded Case Circuit Breakers and Circuit  
Breaker Enclosures

**PART 2 - PRODUCTS**

**2.1 FUSED SWITCHES RATED 600 AMPERES AND LESS**

- A. Switches shall be in accordance with NEMA, NEC, UL, as specified, and as shown on the drawings.
- B. Shall be NEMA classified Heavy Duty (HD).
- C. Shall be horsepower (HP) rated.
- D. Shall have the following features:
  - 1. Switch mechanism shall be the quick-make, quick-break type.
  - 2. Copper blades, visible in the open position.
  - 3. An arc chute for each pole.
  - 4. External operating handle shall indicate open and closed positions, and have lock-open padlocking provisions.
  - 5. Mechanical interlock shall permit opening of the door only when the switch is in the open position, defeatable to permit inspection.
  - 6. Fuse holders for the sizes and types of fuses specified.
  - 7. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.
  - 8. Ground lugs for each ground conductor.
  - 9. Enclosures:
    - a. Shall be the NEMA types shown on the drawings.
    - b. Where the types of switch enclosures are not shown, they shall be the NEMA types most suitable for the ambient environmental conditions.
    - c. Shall be finished with manufacturer's standard gray baked enamel paint over pretreated steel.

**2.2 UNFUSED SWITCHES RATED 600 AMPERES AND LESS**

- A. Shall be the same as fused switches, but without provisions for fuses.

**2.3 FUSED SWITCHES RATED OVER 600 AMPERES TO 1200 AMPERES**

- A. Shall be the same as fused switches, and shall be NEMA classified Heavy Duty (HD).

**2.4 MOTOR RATED TOGGLE SWITCHES**

- A. Type 1, general purpose for single-phase motors rated up to 1 horsepower.
- B. Quick-make, quick-break toggle switch with external reset button and thermal overload protection matched to nameplate full-load current of actual protected motor.

## **2.5 CARTRIDGE FUSES**

- A. Shall be in accordance with NEMA FU 1.
- B. Feeders: Class J, time delay.
- C. Motor Branch Circuits: Class J, time delay.
- D. Control Circuits: Class CC, time delay.

## **2.6 SEPARATELY-ENCLOSED CIRCUIT BREAKERS**

- A. Provide circuit breakers in accordance with the applicable requirements in Section 26 24 16, PANELBOARDS.
- B. Enclosures shall be the NEMA types shown on the drawings. Where the types are not shown, they shall be the NEMA type most suitable for the ambient environmental conditions.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Installation shall be in accordance with the manufacturer's instructions, the NEC, as shown on the drawings, and as specified.
- B. Fused switches shall be furnished complete with fuses. Arrange fuses such that rating information is readable without removing the fuses.

### **3.2 ACCEPTANCE CHECKS AND TESTS**

- A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
  - 1. Visual Inspection and Tests:
    - a. Compare equipment nameplate data with specifications and approved shop drawings.
    - b. Inspect physical, electrical, and mechanical condition.
    - c. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method.
    - d. Vacuum-clean enclosure interior. Clean enclosure exterior.

### **3.3 SPARE PARTS**

- A. Two weeks prior to the final inspection, furnish one complete set of spare fuses for each fused disconnect switch installed on the project. Deliver the spare fuses to the COR.

---END---

**SECTION 26 51 00**  
**INTERIOR LIGHTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

- A. This section specifies the furnishing, installation, and connection of the interior lighting systems. The terms "lighting fixture," "fixture," and "luminaire" are used interchangeably.

**1.2 RELATED WORK**

- A. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT: Disposal of lamps.
- B. Section 02 41 00, DEMOLITION: Removal and disposal of lamps and ballasts.
- E. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- F. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.
- G. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
- H. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1. Shop Drawings:
- a. Submit the following information for each type of lighting fixture designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of lighting fixture designation.
  - b. Material and construction details, include information on housing and optics system.
  - c. Physical dimensions and description.
  - d. Wiring schematic and connection diagram.
  - e. Installation details.
  - f. Energy efficiency data.



- E. Federal Communications Commission (FCC):
  - CFR Title 47, Part 15...Radio Frequency Devices
  - CFR Title 47, Part 18...Industrial, Scientific, and Medical Equipment
- F. Illuminating Engineering Society (IES):
  - LM-79-08.....Electrical and Photometric Measurements of  
Solid-State Lighting Products
  - LM-80-08.....Measuring Lumen Maintenance of LED Light  
Sources
  - LM-82-12.....Characterization of LED Light Engines and LED  
Lamps for Electrical and Photometric Properties  
as a Function of Temperature
- G. Institute of Electrical and Electronic Engineers (IEEE):
  - C62.41-91.....Surge Voltages in Low Voltage AC Power Circuits
- H. International Code Council (ICC):
  - IBC-12.....International Building Code
- I. National Fire Protection Association (NFPA):
  - 70-11.....National Electrical Code (NEC)
  - 101-12.....Life Safety Code
- J. National Electrical Manufacturer's Association (NEMA):
  - C82.1-04.....Lamp Ballasts - Line Frequency Fluorescent Lamp  
Ballasts
  - C82.2-02.....Method of Measurement of Fluorescent Lamp  
Ballasts
  - C82.4-02.....Lamp Ballasts - Ballasts for High-Intensity  
Discharge and Low-Pressure Sodium (LPS) Lamps  
(Multiple-Supply Type)
  - C82.11-11.....Lamp Ballasts - High Frequency Fluorescent Lamp  
Ballasts
  - LL-9-09.....Dimming of T8 Fluorescent Lighting Systems
  - SSL-1-10.....Electronic Drivers for LED Devices, Arrays, or  
Systems
- K. Underwriters Laboratories, Inc. (UL):
  - 496-08.....Lampholders
  - 542-0599.....Fluorescent Lamp Starters
  - 844-12.....Luminaires for Use in Hazardous (Classified)  
Locations
  - 924-12.....Emergency Lighting and Power Equipment

935-01.....Fluorescent-Lamp Ballasts  
1029-94.....High-Intensity-Discharge Lamp Ballasts  
1029A-06.....Ignitors and Related Auxiliaries for HID Lamp  
Ballasts  
1598-08.....Luminaires  
1574-04.....Track Lighting Systems  
2108-04.....Low-Voltage Lighting Systems  
8750-09.....Light Emitting Diode (LED) Light Sources for  
Use in Lighting Products

**PART 2 - PRODUCTS**

**2.1 LED LIGHT FIXTURES**

A. General:

1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
3. LED drivers shall include the following features unless otherwise indicated:
  - a. Minimum efficiency: 85% at full load.
  - b. Minimum Operating Ambient Temperature: -20° C. (-4° F.)
  - c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
  - d. Integral short circuit, open circuit, and overload protection.
  - e. Power Factor: ≥ 0.95.
  - f. Total Harmonic Distortion: ≤ 20%.
  - g. Comply with FCC 47 CFR Part 15.
4. LED modules shall include the following features unless otherwise indicated:
  - a. Comply with IES LM-79 and LM-80 requirements.
  - b. Minimum CRI 80 and color temperature 4000° K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.
  - c. Minimum Rated Life: 50,000 hours per IES L70.
  - d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.

B. LED Troffers:

1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.

2. Housing, LED driver, and LED module shall be products of the same manufacturer.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Installation shall be in accordance with the NEC, manufacturer's instructions, and as shown on the drawings or specified.
- B. Align, mount, and level the lighting fixtures uniformly.
- C. Wall-mounted fixtures shall be attached to the studs in the walls, or to a 20 gauge metal backing plate that is attached to the studs in the walls. Lighting fixtures shall not be attached directly to gypsum board.
- D. Lighting Fixture Supports:
  1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
  2. Shall maintain the fixture positions after cleaning and relamping.
  3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
  4. Single or double pendant-mounted lighting fixtures:
    - a. Each stem shall be supported by an approved outlet box mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure.
  5. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.
- E. Furnish and install the new lamps as specified for all lighting fixtures installed under this project, and for all existing lighting fixtures reused under this project.
- F. The electrical and ceiling trades shall coordinate to ascertain that approved lighting fixtures are furnished in the proper sizes and



installed with the proper devices (hangers, clips, trim frames, flanges, etc.), to match the ceiling system being installed.

- G. Bond lighting fixtures to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- H. At completion of project, replace all defective components of the lighting fixtures at no cost to the Government.

### **3.2 ACCEPTANCE CHECKS AND TESTS**

A. Perform the following:

1. Visual Inspection:

- a. Verify proper operation by operating the lighting controls.
- b. Visually inspect for damage to fixtures, lenses, reflectors, diffusers, and louvers. Clean fixtures, lenses, reflectors, diffusers, and louvers that have accumulated dust, dirt, or fingerprints during construction.

2. Electrical tests:

- a. Exercise dimming components of the lighting fixtures over full range of dimming capability by operating the control devices(s) in the presence of the COR. Observe for visually detectable flicker over full dimming range, and replace defective components at no cost to the Government.
- b. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Government. Burn-in period to be 40 hours minimum, unless specifically recommended otherwise by the lamp manufacturer. Burn-in dimmed fluorescent and compact fluorescent lamps for at least 100 hours at full voltage, unless specifically recommended otherwise by the lamp manufacturer. Replace any lamps and ballasts which fail during burn-in.

### **3.3 FOLLOW-UP VERIFICATION**

- A. Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting systems are in good operating condition and properly performing the intended function.

---END---

**SECTION 27 05 11  
 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section includes common requirements to communications installations.
- B. Provide completely functioning communications systems.
- C. Comply with VAAR 852.236.91 and FAR clause 52.236-21 in circumstance of a need for additional detail or conflict between drawings, specifications, reference standards or code.

**1.2 REFERENCES**

- A. Abbreviations and Acronyms
  - 1. Refer to <http://www.cfm.va.gov/til/sdetail.asp> for Division 00, ARCHITECTURAL ABBREVIATIONS.
  - 2. Additional Abbreviations and Acronyms:

A	Ampere
AC	Alternating Current
AE	Architect and Engineer
AFF	Above Finished Floor
AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute
AWG	American Wire Gauge (refer to STP and UTP)
AWS	Advanced Wireless Services
BCT	Bonding Conductor for Telecommunications (also Telecommunications Bonding Conductor (TBC))
BDA	Bi-Directional Amplifier
BICSI	Building Industry Consulting Service International
BIM	Building Information Modeling
BOM	Bill of Materials
BTU	British Thermal Units
BUCR	Back-up Computer Room
BTS	Base Transceiver Station
CAD	AutoCAD
CBOPC	Community Based Out Patient Clinic

CBC	Coupled Bonding Conductor
CBOC	Community Based Out Patient Clinic (refer to CBOPC, OPC, VAMC)
CCS	TIP's Cross Connection System (refer to VCCS and HCCS)
CFE	Contractor Furnished Equipment
CFM	US Department of Veterans Affairs Office of Construction and Facilities Management
CFR	Consolidated Federal Regulations
CIO	Communication Information Officer (Facility, VISN or Region)
cm	Centimeters
CO	Central Office
COR	Contracting Officer Representative
CPU	Central Processing Unit
CSU	Customer Service Unit
CUP	Conditional Use Permit(s) - Federal/GSA for VA
dB	Decibel
dBm	Decibel Measured
dBmV	Decibel per milli-Volt
DC	Direct Current
DEA	United States Drug Enforcement Administration
DSU	Data Service Unit
EBC	Equipment Bonding Conductor
ECC	Engineering Control Center (refer to DCR, EMCR)
EDGE	Enhanced Data (Rates) for GSM Evolution
EDM	Electrical Design Manual
EMCR	Emergency Management Control Room (refer to DCR, ECC)
EMI	Electromagnetic Interference (refer to RFI)
EMS	Emergency Medical Service
EMT	Electrical Metallic Tubing or thin wall conduit
ENTR	Utilities Entrance Location (refer to DEMARC, POTS, LEC)

EPBX	Electronic Digital Private Branch Exchange
ESR	Vendor's Engineering Service Report
FA	Fire Alarm
FAR	Federal Acquisition Regulations in Chapter 1 of Title 48 of Code of Federal Regulations
FMS	VA's Headquarters or Medical Center Facility's Management Service
FR	Frequency (refer to RF)
FTS	Federal Telephone Service
GFE	Government Furnished Equipment
GPS	Global Positioning System
GRC	Galvanized Rigid Metal Conduit
GSM	Global System (Station) for Mobile
HCCS	TIP's Horizontal Cross Connection System (refer to CCS & VCCS)
HDPE	High Density Polyethylene Conduit
HDTV	Advanced Television Standards Committee High-Definition Digital Television
HEC	Head End Cabinets(refer to HEIC, PA)
HEIC	Head End Interface Cabinets(refer to HEC, PA)
HF	High Frequency (Radio Band; Re FR, RF, VHF & UHF)
HSPA	High Speed Packet Access
HZ	Hertz
IBT	Intersystem Bonding Termination (NEC 250.94)
IC	Intercom
ICRA	Infectious Control Risk Assessment
IDEN	Integrated Digital Enhanced Network
IDC	Insulation Displacement Contact
IDF	Intermediate Distribution Frame
ILSM	Interim Life Safety Measures
IMC	Rigid Intermediate Steel Conduit
IRM	Department of Veterans Affairs Office of Information Resources Management

ISDN	Integrated Services Digital Network
ISM	Industrial, Scientific, Medical
IWS	Intra-Building Wireless System
LAN	Local Area Network
LBS	Location Based Services, Leased Based Systems
LEC	Local Exchange Carrier (refer to DEMARC, PBX & POTS)
LED	Light Emitting Diode
LMR	Land Mobile Radio
LTE	Long Term Evolution, or 4G Standard for Wireless Data Communications Technology
M	Meter
MAS	Medical Administration Service
MATV	Master Antenna Television
MCR	Main Computer Room
MCOR	Main Computer Operators Room
MDF	Main Distribution Frame
MH	Manholes or Maintenance Holes
MHz	Megahertz ( $10^6$ Hz)
mm	Millimeter
MOU	Memorandum of Understanding
MW	Microwave (RF Band, Equipment or Services)
NID	Network Interface Device (refer to DEMARC)
NEC	National Electric Code
NOR	Network Operations Room
NRTL	OSHA Nationally Recognized Testing Laboratory
NS	Nurse Stations
NTIA	U.S. Department of Commerce National Telecommunications and Information Administration
OEM	Original Equipment Manufacturer
OI&T	Office of Information and Technology
OPC	VA's Outpatient Clinic (refer to CBOC, VAMC)
OSH	Department of Veterans Affairs Office of Occupational Safety and Health

OSHA	United States Department of Labor Occupational Safety and Health Administration
OTDR	Optical Time-Domain Reflectometer
PA	Public Address System (refer to HE, HEIC, RPEC)
PBX	Private Branch Exchange (refer to DEMARC, LEC, POTS)
PCR	Police Control Room (refer to SPCC, could be designated SCC)
PCS	Personal Communications Service (refer to UPCS)
PE	Professional Engineer
PM	Project Manager
PoE	Power over Ethernet
POTS	Plain Old Telephone Service (refer to DEMARC, LEC, PBX)
PSTN	Public Switched Telephone Network
PSRAS	Public Safety Radio Amplification Systems
PTS	Pay Telephone Station
PVC	Poly-Vinyl Chloride
PWR	Power (in Watts)
RAN	Radio Access Network
RBB	Rack Bonding Busbar
RE	Resident Engineer or Senior Resident Engineer
RF	Radio Frequency (refer to FR)
RFI	Radio Frequency Interference (refer to EMI)
RFID	RF Identification (Equipment, System or Personnel)
RMC	Rigid Metal Conduit
RMU	Rack Mounting Unit
RPEC	Radio Paging Equipment Cabinets(refer to HEC, HEIC, PA)
RTLS	Real Time Location Service or System
RUS	Rural Utilities Service
SCC	Security Control Console (refer to PCR, SPCC)
SMCS	Spectrum Management and Communications Security (COMSEC)

SFO	Solicitation for Offers
SME	Subject Matter Experts (refer to AHJ)
SMR	Specialized Mobile Radio
SMS	Security Management System
SNMP	Simple Network Management Protocol
SPCC	Security Police Control Center (refer to PCR, SMS)
STP	Shielded Balanced Twisted Pair (refer to UTP)
STR	Stacked Telecommunications Room
TAC	VA's Technology Acquisition Center, Austin, Texas
TCO	Telecommunications Outlet
TER	Telephone Equipment Room
TGB	Telecommunications Grounding Busbar (also Secondary Bonding Busbar (SBB))
TIP	Telecommunications Infrastructure Plant
TMGB	Telecommunications Main Grounding Busbar (also Primary Bonding Busbar (PBB))
TMS	Traffic Management System
TOR	Telephone Operators Room
TP	Balanced Twisted Pair (refer to STP and UTP)
TR	Telecommunications Room (refer to STR)
TWP	Twisted Pair
UHF	Ultra High Frequency (Radio)
UMTS	Universal Mobile Telecommunications System
UPCS	Unlicensed Personal Communications Service (refer to PCS)
UPS	Uninterruptible Power Supply
USC	United States Code
UTP	Unshielded Balanced Twisted Pair (refer to TP and STP)
UV	Ultraviolet
V	Volts
VAAR	Veterans Affairs Acquisition Regulation
VACO	Veterans Affairs Central Office

VAMC	VA Medical Center (refer to CBOC, OPC, VACO)
VCCS	TIP's Vertical Cross Connection System (refer to CCS and HCCS)
VHF	Very High Frequency (Radio)
VISN	Veterans Integrated Services Network (refers to geographical region)
VSWR	Voltage Standing Wave Ratio
W	Watts
WEB	World Electronic Broadcast
WiMAX	Worldwide Interoperability (for MW Access)
WI-FI	Wireless Fidelity
WMTS	Wireless Medical Telemetry Service
WSP	Wireless Service Providers

B. Definitions:

1. Access Floor: Pathway system of removable floor panels supported on adjustable pedestals to allow cable placement in area below.
2. BNC Connector (BNC): United States Military Standard MIL-C-39012/21 bayonet-type coaxial connector with quick twist mating/unmating, and two lugs preventing accidental disconnection from pulling forces on cable.
3. Bond: Permanent joining of metallic parts to form an electrically conductive path to ensure electrical continuity and capacity to safely conduct any currents likely to be imposed to earth ground.
4. Bundled Microducts: All forms of jacketed microducts.
5. Conduit: Includes all raceway types specified.
6. Conveniently Accessible: Capable of being reached without use of ladders, or without climbing or crawling under or over obstacles such as, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.
7. Distributed (in house) Antenna System (DAS): An Emergency Radio Communications System installed for Emergency Responder (or first responders and Government personnel) use while inside facility to maintain contact with each respective control point; refer to Section 27 53 19, DISTRIBUTED RADIO ANTENNA (WITHIN BUILDING) EQUIPMENT AND SYSTEMS.



8. DEMARC, Extended DMARC or ENTR: Service provider's main point of demarcation owned by LEC or service provider and establishes a physical point where service provider's responsibilities for service and maintenance end. This point is called NID, in data networks.
9. Effectively Grounded: Intentionally bonded to earth through connections of low impedance having current carrying capacity to prevent buildup of currents and voltages resulting in hazard to equipment or persons.
10. Electrical Supervision: Analyzing a system's function and components (i.e. cable breaks / shorts, inoperative stations, lights, LEDs and states of change, from primary to backup) on a 24/7/365 basis; provide aural and visual emergency notification signals to minimum two remote designated or accepted monitoring stations.
11. Electrostatic Interference (ESI) or Electrostatic Discharge Interference: Refer to EMI and RFI.
12. Emergency Call Systems: Wall units (in parking garages and stairwells) and pedestal mounts (in parking lots) typically provided with a strobe, camera and two-way audio communication functions. Project 25 (2014) (P25 (TIA-102 Series)): Set of standards for local, state and Federal public safety organizations and agencies digital LMR services. P25 is applicable to LMR equipment authorized or licensed under the US Department of Commerce National Telecommunications and Information Administration or FCC rules and regulations, and is a required standard capability for all LMR equipment and systems.
13. Grounding Electrode Conductor: (GEC) Conductor connected to earth grounding electrode.
14. Grounding Electrode System: Electrodes through which an effective connection to earth is established, including supplementary, communications system grounding electrodes and GEC.
15. Grounding Equalizer or Backbone Bonding Conductor (BBC): Conductor that interconnects elements of telecommunications grounding infrastructure.
16. Head End (HE): Equipment, hardware and software, or a master facility at originating point in a communications system designed for centralized communications control, signal processing, and distribution that acts as a common point of connection between

- equipment and devices connected to a network of interconnected equipment, possessing greatest authority for allowing information to be exchanged, with whom other equipment is subordinate.
17. Microducts: All forms of air blown fiber pathways.
  18. Ohm: A unit of restive measurement.
  19. Received Signal Strength Indication (RSSI): A measurement of power present in a received RF signal.
  20. Service Provider Demarcation Point (SPDP): Not owned by LEC or service provider, but designated by Government as point within facility considered the DEMARC.
  21. Sound (SND): Changing air pressure to audible signals over given time span.
  22. System: Specific hardware, firmware, and software, functioning together as a unit, performing task for which it was designed.
  23. Telecommunications Bonding Backbone (TBB): Conductors of appropriate size (minimum 53.49 mm<sup>2</sup> [1/0 AWG]) stranded copper wire, that connect to Grounding Electrode System and route to telecommunications main grounding busbar (TMGB) and circulate to interconnect various TGBs and other locations shown on drawings.
  24. Voice over Internet Protocol (VoIP): A telephone system in which voice signals are converted to packets and transmitted over LAN network using Transmission Control Protocol (TCP)/Internet Protocol (IP). VA'S VoIP is not listed or coded for life and public safety, critical, emergency or other protection functions. When VoIP system or equipment is provided instead of PBX system or equipment, each TR (STR) and DEMARC requires increased AC power provided to compensate for loss of PBX's telephone instrument line power; and, to compensate for absence of PBX's UPS capability.
  25. Wide Area Network (WAN): A digital network that transcends localized LANs within a given geographic location. VA'S WAN/LAN is not nationally listed or coded for life and public safety, critical, emergency or other safety functions.

### **1.3 APPLICABLE PUBLICATIONS**

- A. Applicability of Standards: Unless documents include more stringent requirements, applicable construction industry standards have same force and effect as if bound or copied directly into the documents to

extent referenced. Such standards are made a part of these documents by reference.

1. Each entity engaged in construction must be familiar with industry standards applicable to its construction activity.
2. Obtain standards directly from publication source, where copies of standards are needed to perform a required construction activity.

B. Government Codes, Standards and Executive Orders: Refer to

<http://www.cfm.va.gov/TIL/cPro.asp>:

1. Federal Communications Commission, (FCC) CFR, Title 47:

Part 15	Restrictions of use for Part 15 listed RF Equipment in Safety of Life Emergency Functions and Equipment Locations
Part 47	Chapter A, Paragraphs 6.1-6.23, Access to Telecommunications Service, Telecommunications Equipment and Customer Premises Equipment
Part 58	Television Broadcast Service
Part 73	Radio and Television Broadcast Rules
Part 90	Rules and Regulations, Appendix C
Form 854	Antenna Structure Registration
Chapter XXIII	National Telecommunications and Information Administration (NTIA, P/O Commerce, Chapter XXIII) the 'Red Book'- Chapters 7, 8 & 9 compliments CFR, Title 47, FCC Part 15, RF Restriction of Use and Compliance in "Safety of Life" Functions & Locations

2. US Department of Agriculture, (Title 7, USC, Chapter 55, Sections 2201, 2202 & 2203:RUS 1755 Telecommunications Standards and Specifications for Materials, Equipment and Construction:

RUS Bull 1751F-630	Design of Aerial Cable Plants
RUS Bull 1751F-640	Design of Buried Cable Plant, Physical Considerations
RUS Bull 1751F-643	Underground Plant Design
RUS Bull 1751F-815	Electrical Protection of Outside Plants,
RUS Bull 1753F-201	Acceptance Tests of Telecommunications Plants (PC-4)
RUS Bull 1753F-401	Splicing Copper and Fiber Optic Cables (PC-2)
RUS Bull 345-50	Trunk Carrier Systems (PE-60)

- RUS Bull 345-65            Shield Bonding Connectors (PE-65)  
RUS Bull 345-72            Filled Splice Closures (PE-74)  
RUS Bull 345-83            Gas Tube Surge Arrestors (PE-80)
3. US Department of Commerce/National Institute of Standards  
Technology, (NIST):
- FIPS PUB 1-1                Telecommunications Information Exchange  
FIPS PUB 100/1              Interface between Data Terminal Equipment (DTE)  
Circuit Terminating Equipment for operation  
with Packet Switched Networks, or Between Two  
DTEs, by Dedicated Circuit  
FIPS PUB 140/2              Telecommunications Information Security  
Algorithms  
FIPS PUB 143                General Purpose 37 Position Interface between  
DTE and Data Circuit Terminating Equipment  
FIPS 160/2                 Electronic Data Interchange (EDI),  
FIPS 175                    Federal Building Standard for  
Telecommunications Pathway and Spaces  
FIPS 191                    Guideline for the Analysis of Local Area  
Network Security  
FIPS 197                    Advanced Encryption Standard (AES)  
FIPS 199                    Standards for Security Categorization of  
Federal Information and Information Systems
4. US Department of Defense, (DoD):
- MIL-STD-188-110            Interoperability and Performance Standards for  
Data Modems  
MIL-STD-188-114            Electrical Characteristics of Digital Interface  
Circuits  
MIL-STD-188-115            Communications Timing and Synchronizations  
Subsystems  
MIL-C-28883                Advanced Narrowband Digital Voice Terminals  
MIL-C-39012/21             Connectors, Receptacle, Electrical, Coaxial,  
Radio Frequency, (Series BNC (Uncabled), Socket  
Contact, Jam Nut Mounted, Class 2)
5. US Department of Health and Human Services:  
The Health Insurance Portability and Accountability Act of 1996  
(HIPAA) Privacy, Security and Breach Notification Rules
6. US Department of Justice:

2010 Americans with Disabilities Act Standards for Accessible Design (ADAAD).

7. US Department of Labor, (DoL) - Public Law 426-62 - CFR, Title 29, Part 1910, Chapter XVII - Occupational Safety and Health Administration (OSHA), Occupational Safety and Health Standards):
  - Subpart 7 Approved NRTLs; obtain a copy at [http://www.osha.gov/dts/otpca/nrtl/faq\\_nrtl.htm](http://www.osha.gov/dts/otpca/nrtl/faq_nrtl.htm)  
1)
  - Subpart 35 Compliance with NFPA 101, Life Safety Code
  - Subpart 36 Design and Construction Requirements for Exit Routes
  - Subpart 268 Telecommunications
  - Subpart 305 Wiring Methods, Components, and Equipment for General Use
  - Subpart 508 Americans with Disabilities Act Accessibility Guidelines; technical requirement for accessibility to buildings and facilities by individuals with disabilities
8. US Department of Transportation, (DoT):
  - a. Public Law 85-625, CFR, Title 49, Part 1, Subpart C - Federal Aviation Administration (FAA):AC 110/460-ID & AC 707 / 460-2E - Advisory Circulars Standards for Construction of Antenna Towers, and 7450 and 7460-2 - Antenna Construction Registration Forms.
9. US Department of Veterans Affairs (VA): Office of Telecommunications (OI&T), MP-6, PART VIII, TELECOMMUNICATIONS, CHAPTER 5, AUDIO, RADIO AND TELEVISION (and COMSEC) COMMUNICATIONS SYSTEMS: Spectrum Management and COMSEC Service (SMCS), AHJ for:
  - a. CoG, "Continuance of Government" communications guidelines and compliance.
  - b. COMSEC, "VA wide coordination and control of security classified communication assets."
  - c. COOP, "Continuance of Operations" emergency communications guidelines and compliance.
  - d. FAA, FCC, and US Department of Commerce National Telecommunications and Information Administration, "VA wide RF Co-ordination, Compliance and Licensing."

- e. Handbook 6100 - Telecommunications: Cyber and Information Security Office of Cyber and Information Security, and Handbook 6500 - Information Security Program.
  - f. Low Voltage Special Communications Systems "Design, Engineering, Construction Contract Specifications and Drawings Conformity, Proof of Performance Testing, VA Compliance and Life Safety Certifications for CFM and VA Facility Low Voltage Special Communications Projects (except Fire Alarm, Telephone and Data Systems)."
  - g. SATCOM, "Satellite Communications" guidelines and compliance, and Security and Law Enforcement Systems - "Coordinates the Design, Engineering, Construction Contract Specifications and Drawings Conformity, Proof of Performance Testing, VA Compliance, DEA and Public Safety Certification(s) for CFM and VA Facility Security Low Voltage Special Communications and Physical Security Projects.
  - h. VHA's National Center for Patient Safety - Veterans Health Administration (VHA) Warning System, Failure of Medical Alarm Systems using Paging Technology to Notify Clinical Staff, July 2004.
  - i. VA's CEOSH, concurrence with warning identified in VA Directive 7700.
  - j. Wireless and Handheld Devices, "Guidelines and Compliance,"
  - k. Office of Security and Law Enforcement: VA Directive 0730 and Health Special Presidential Directive (HSPD)-12.
- C. NRTL Standards: Refer to <https://www.osha.gov/dts/otpca/nrtl/index.html>
- 1. Canadian Standards Association (CSA); same tests as presented by UL
  - 2. Communications Certifications Laboratory (CEL); same tests as presented by UL.
  - 3. Intertek Testing Services NA, Inc., (ITSNA), formerly Edison Testing Laboratory (ETL) same tests as presented by UL).
  - 4. Underwriters Laboratory (UL):
    - 1-2005 Flexible Metal Conduit
    - 5-2011 Surface Metal Raceway and Fittings
    - 6-2007 Rigid Metal Conduit
    - 44-010 Thermoset-Insulated Wires and Cables
    - 50-1995 Enclosures for Electrical Equipment

65-2010	Wired Cabinets
83-2008	Thermoplastic-Insulated Wires and Cables
96-2005	Lightning Protection Components
96A-2007	Installation Requirements for Lightning Protection Systems
360-2013	Liquid-Tight Flexible Steel Conduit
444-2008	Communications Cables
467-2013	Grounding and Bonding Equipment
486A-486B-2013	Wire Connectors
486C-2013	Splicing Wire Connectors
486D-2005	Sealed Wire Connector Systems
486E-2009	Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
493-2007	Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable
497/497A/497B/497C 497D/497E	Protectors for Paired Conductors/Communications Circuits/Data Communications and Fire Alarm Circuits/coaxial circuits/voltage protections/Antenna Lead In
510-2005	Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
514A-2013	Metallic Outlet Boxes
514B-2012	Fittings for Cable and Conduit
514C-1996	Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
651-2011	Schedule 40 and 80 Rigid PVC Conduit
651A-2011	Type EB and A Rigid PVC Conduit and HDPE Conduit
797-2007	Electrical Metallic Tubing
884-2011	Underfloor Raceways and Fittings
1069-2007	Hospital Signaling and Nurse Call Equipment
1242-2006	Intermediate Metal Conduit
1449-2006	Standard for Transient Voltage Surge Suppressors
1479-2003	Fire Tests of Through-Penetration Fire Stops

1480-2003	Speaker Standards for Fire Alarm, Emergency, Commercial and Professional use
1666-2007	Standard for Wire/Cable Vertical (Riser) Tray Flame Tests
1685-2007	Vertical Tray Fire Protection and Smoke Release Test for Electrical and Fiber Optic Cables
1861-2012	Communication Circuit Accessories
1863-2013	Standard for Safety, communications Circuits Accessories
1865-2007	Standard for Safety for Vertical-Tray Fire Protection and Smoke-Release Test for Electrical and Optical-Fiber Cables
2024-2011	Standard for Optical Fiber Raceways
2024-2014	Standard for Cable Routing Assemblies and Communications Raceways
2196-2001	Standard for Test of Fire Resistive Cable
60950-1 ed. 2-2014	Information Technology Equipment Safety

D. Industry Standards:

1. Advanced Television Systems Committee (ATSC):
  - A/53 Part 1: 2013 ATSC Digital Television Standard, Part 1, Digital Television System
  - A/53 Part 2: 2011 ATSC Digital Television Standard, Part 2, RF/Transmission System Characteristics
  - A/53 Part 3: 2013 ATSC Digital Television Standard, Part 3, Service Multiplex and Transport System Characteristics
  - A/53 Part 4: 2009 ATSC Digital Television Standard, Part 4, MPEG-2 Video System Characteristics
  - A/53 Part 5: 2014 ATSC Digital Television Standard, Part 5, AC-3 Audio System Characteristics
  - A/53 Part 6: 2014 ATSC digital Television Standard, Part 6, Enhanced AC-3 Audio System Characteristics
2. American Institute of Architects (AIA): 2006 Guidelines for Design & Construction of Health Care Facilities.
3. American Society of Mechanical Engineers (ASME):
  - A17.1 (2013) Safety Code for Elevators and Escalators Includes Requirements for Elevators,



- Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices
- 17.3 (2011) Safety Code for Existing Elevators and Escalators
- 17.4 (2009) Guide for Emergency Personnel
- 17.5 (2011) Elevator and Escalator Electrical Equipment
4. American Society for Testing and Materials (ASTM):
- B1 (2001) Standard Specification for Hard-Drawn Copper Wire
- B8 (2004) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- D1557 (2012) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)
- D2301 (2004) Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape
- B258-02 (2008) Standard Specification for Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors
- D709-01(2007) Standard Specification for Laminated Thermosetting Materials
- D4566 (2008) Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable
5. American Telephone and Telegraph Corporation (AT&T) - Obtain following AT&T Publications at <https://ebiznet.sbc.com/SBCNEBS/>):
- ATT-TP-76200 (2013) Network Equipment and Power Grounding, Environmental, and Physical Design Requirements
- ATT-TP-76300(2012) Merged AT&T Affiliate Companies Installation Requirements
- ATT-TP-76305 (2013) Common Systems Cable and Wire Installation and Removal Requirements - Cable Racks and Raceways
- ATT-TP-76306 (2009) Electrostatic Discharge Control

- ATT-TP-76400 (2012) Detail Engineering Requirements
- ATT-TP-76402 (2013) AT&T Raised Access Floor Engineering and  
Installation Requirements
- ATT-TP-76405 (2011) Technical Requirements for Supplemental Cooling  
Systems in Network Equipment Environments
- ATT-TP-76416 (2011) Grounding and Bonding Requirements for Network  
Facilities
- ATT-TP-76440 (2005) Ethernet Specification
- ATT-TP-76450 (2013) Common Systems Equipment Interconnection  
Standards for AT&T Network Equipment Spaces
- ATT-TP-76461 (2008) Fiber Optic Cleaning
- ATT-TP-76900 (2010) AT&T Installation Testing Requirement
- ATT-TP-76911 (1999) AT&T LEC Technical Publication Notice
6. British Standards Institution (BSI):
- BS EN 50109-2 Hand Crimping Tools - Tools for The Crimp  
Termination of Electric Cables and Wires for  
Low Frequency and Radio Frequency Applications  
- All Parts & Sections. October 1997
7. Building Industry Consulting Service International(BICSI):
- ANSI/BICSI 002-2011 Data Center Design and Implementation Best  
Practices
- ANSI/BICSI 004-2012 Information Technology Systems Design and  
Implementation Best Practices for Healthcare  
Institutions and Facilities
- ANSI/NECA/BICSI  
568-2006 Standard for Installing Commercial Building  
Telecommunications Cabling
- NECA/BICSI 607-2011 Standard for Telecommunications Bonding and  
Grounding Planning and Installation Methods for  
Commercial Buildings
- ANSI/BICSI 005-2013 Electronic Safety and Security (ESS) System  
Design and Implementation Best Practices
8. Electronic Components Assemblies and Materials Association,(ECA).
- ECA EIA/RS-270 (1973)Tools, Crimping, Solderless Wiring Devices -  
Recommended Procedures for User Certification
- EIA/ECA 310-E (2005) Cabinets, and Associated Equipment

9. Facility Guidelines Institute: 2010 Guidelines for Design and Construction of Health Care Facilities.
10. Insulated Cable Engineers Association (ICEA):
  - ANSI/ICEA  
S-80-576-2002                   Category 1 & 2 Individually Unshielded Twisted-Pair Indoor Cables for Use in Communications Wiring Systems
  - ANSI/ICEA  
S-84-608-2010                   Telecommunications Cable, Filled Polyolefin Insulated Copper Conductor, S-87-640(2011) Optical Fiber Outside Plant Communications Cable
  - ANSI/ICEA  
S-90-661-2012                   Category 3, 5, & 5e Individually Unshielded Twisted-Pair Indoor Cable for Use in General Purpose and LAN Communication Wiring Systems
  - S-98-688 (2012)                   Broadband Twisted Pair Cable Aircore, Polyolefin Insulated, Copper Conductors
  - S-99-689 (2012)                   Broadband Twisted Pair Cable Filled, Polyolefin Insulated, Copper Conductors
  - ICEA S-102-700  
(2004)                            Category 6 Individually Unshielded Twisted Pair Indoor Cables (With or Without an Overall Shield) for use in Communications Wiring Systems Technical Requirements
11. Institute of Electrical and Electronics Engineers (IEEE):
  - ISSN 0739-5175                   March-April 2008 Engineering in Medicine and Biology Magazine, IEEE (Volume: 27, Issue:2) Medical Grade-Mission Critical-Wireless Networks
  - IEEE C2-2012                    National Electrical Safety Code (NESC)
  - C62.41.2-2002/  
Cor 1-2012 IEEE                   Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits 4)

- C62.45-2002 IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits
- 81-2012 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System
- 100-1992 IEEE the New IEEE Standards Dictionary of Electrical and Electronics Terms
- 602-2007 IEEE Recommended Practice for Electric Systems in Health Care Facilities
- 1100-2005 IEEE Recommended Practice for Powering and Grounding Electronic Equipment
12. International Code Council:  
AC193 (2014) Mechanical Anchors in Concrete Elements
13. International Organization for Standardization (ISO):  
ISO/TR 21730 (2007) Use of Mobile Wireless Communication and Computing Technology in Healthcare Facilities - Recommendations for Electromagnetic Compatibility (Management of Unintentional Electromagnetic Interference) with Medical Devices
14. National Electrical Manufacturers Association (NEMA):  
NEMA 250 (2008) Enclosures for Electrical Equipment (1,000V Maximum)  
ANSI C62.61 (1993) American National Standard for Gas Tube Surge Arresters on Wire Line Telephone Circuits  
ANSI/NEMA FB 1 (2012) Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing (EMT) and Cable  
ANSI/NEMA OS 1 (2009) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports  
NEMA SB 19 (R2007) NEMA Installation Guide for Nurse Call Systems  
TC 3 (2004) Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing  
NEMA VE 2 (2006) Cable Tray Installation Guidelines
15. National Fire Protection Association (NFPA):  
70E-2015 Standard for Electrical Safety in the Workplace

- |   |   |
|---|---|
| 70-2014   | National Electrical Code (NEC)  |
| 72-2013   | National Fire Alarm Code  |
| 75-2013   | Standard for the Fire Protection of Information Technological Equipment                                   |
| 76-2012   | Recommended Practice for the Fire Protection of Telecommunications Facilities                             |
| 77-2014   | Recommended Practice on Static Electricity  |
| 90A-2015  | Standard for the Installation of Air Conditioning and Ventilating Systems                                 |
| 99-2015   | Health Care Facilities Code   |
| 101-2015  | Life Safety Code  |
| 241   | Safeguarding construction, alternation and Demolition Operations  |
| 255-2006  | Standard Method of Test of Surface Burning Characteristics of Building Materials                          |
| 262 - 2011  | Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces     |
| 780-2014  | Standard for the Installation of Lightning Protection Systems   |
| 1221-2013   | Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems          |
| 5000-2015   | Building Construction and Safety Code   |
| 16. Society for Protective Coatings (SSPC):               |   |
| SSPC SP 6/NACE No.3 (2007)                                | Commercial Blast Cleaning   |
| 17. Society of Cable Telecommunications Engineers (SCTE): |   |
| ANSI/SCTE 15 2006   | Specification for Trunk, Feeder and Distribution Coaxial Cable  |
| 18. Telecommunications Industry Association (TIA):        |   |
| TIA-120 Series  | Telecommunications Land Mobile communications (APCO/Project 25) (January 2014)                            |
| TIA TSB-140   | Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems (2004) |

TIA-155	Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T (2010)
TIA TSB-162-A	Telecommunications Cabling Guidelines for Wireless Access Points (2013)
TIA-222-G	Structural Standard for Antenna Supporting Structures and Antennas (2014)
TIA/EIA-423-B	Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits (2012)
TIA-455-C	General Requirements for Standard Test Procedures for Optical Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components (August 2014)
TIA-455-53-A	FOTP-53 Attenuation by Substitution Measurements for Multimode Graded-Index Optical Fibers in Fiber Assemblies (Long Length) (September 2001)
TIA-455-61-A	FOTP-61 Measurement of Fiber of Cable Attenuation Using an OTDR (July 2003)
TIA-472D000-B	Fiber Optic Communications Cable for Outside Plant Use (July 2007)
ANSI/TIA-492-B	62.5- $\mu$ Core Diameter/125- $\mu$ m Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers (November 2009)
ANSI/TIA-492AAAB-A	50- $\mu$ m Core Diameter/125- $\mu$ m Cladding Diameter Class IA Graded-Index Multimode Optically Optimized American Standard Fibers (November 2009)
TIA-492CAAA	Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers (September 2002)
TIA-492E000	Sectional Specification for Class IVd Nonzero-Dispersion Single-Mode Optical Fibers for the 1,550 nm Window (September 2002)

TIA-526-7-B Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant - OFSTP-7 (December 2008)

TIA-526.14-A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant - SFSTP-14 (August 1998)

TIA-568 Revision/Edition: C Commercial Building Telecommunications Cabling Standard Set: (TIA-568-C.0-2 Generic Telecommunications Cabling for Customer Premises (2012), TIA-568-C.1-1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements (2012), TIA-568-C.2 Commercial Building Telecommunications Cabling Standard-Part 2: Balanced Twisted Pair Cabling Components (2009), TIA-568-C.3-1 Optical Fiber Cabling Components Standard, (2011) AND TIA-568-C.4 Broadband Coaxial Cabling and Components Standard (2011) with addendums and erratas

TIA-569 Revision/Edition C Telecommunications Pathways and Spaces (March 2013)

TIA-574 Position Non-Synchronous Interface between Data Terminal equipment and Data Circuit Terminating Equipment Employing Serial Binary Interchange (May 2003)

TIA/EIA-590-A Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant (July 2001)

TIA-598-D Optical Fiber Cable Color Coding (January 2005)

TIA-604-10-B Fiber Optic Connector Intermateability Standard (August 2008)

ANSI/TIA-606-B Administration Standard for Telecommunications Infrastructure (2012)

TIA-607-B Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises (January 2013)

TIA-613	High Speed Serial Interface for Data Terminal Equipment and Data Circuit Terminal Equipment (September 2005)
ANSI/TIA-758-B	Customer-owned Outside Plant Telecommunications Infrastructure Standard (April 2012)
ANSI/TIA-854	A Full Duplex Ethernet Specification for 1000 Mb/s (1000BASE-TX) Operating over Category 6 Balanced Twisted-Pair Cabling (2001)
ANSI/TIA-862-A	Building Automation Systems Cabling Standard (April 2011)
TIA-942-A	Telecommunications Infrastructure Standard for Data Centers (March 2014)
TIA-1152	Requirements for Field Testing Instruments and Measurements for Balanced Twisted Pair Cabling (September 2009)
TIA-1179	Healthcare Facility Telecommunications Infrastructure Standard (July 2010)

#### **1.4 SINGULAR NUMBER**

- A. Where any device or part of equipment is referred in singular number (such as " rack"), reference applies to as many such devices as are required to complete installation.

#### **1.5 RELATED WORK**

- A. Specification Order of Precedence: FAR Clause 52.236-21, VAAR Clause 852.236-71.
1. Field Cutting and Patching: Section 09 91 00, PAINTING.
  2. Additional submittal requirements: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
  3. Availability and source of references and standards specified in applicable publications: Section 01 42 19, REFERENCE STANDARDS.
  4. Control of environmental pollution and damage for air, water, and land resources: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
  5. Closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction: Section 07 84 00, FIRESTOPPING.
  6. Sealant and caulking materials and their application: Section 07 92 00, JOINT SEALANTS.



7. General electrical requirements that are common to more than one section of Division 26: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
8. Electrical conductors and cables in electrical systems rated 600 V and below: Section 26 05 21, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).
9. Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
10. Conduit and boxes: Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
11. Wiring devices: Section 26 27 26, WIRING DEVICES.

#### **1.6 ADMINISTRATIVE REQUIREMENTS**

- A. Assign a single communications project manager to serve as point of contact for Government, contractor, and design professional.
- B. Be proactive in scheduling work.
  1. Use of premises is restricted at times directed by COR.
  2. Movement of materials: Unload materials and equipment delivered to site.
  3. Coordinate installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
  4. Sequence, coordinate, and integrate installations of materials and equipment for efficient flow of Work.
  5. Coordinate connection of materials, equipment, and systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies; provide required connection for each service.
  6. Initiate and maintain discussion regarding schedule for ceiling construction and install cables to meet that schedule.
- C. Contact the Office of Telecommunications, Special Communications Team (0050P2H3) (202)461-5310 to have a Government-accepted Telecommunications COR assigned to project for telecommunications review, equipment and system approval and coordination with other VA personnel.
- D. Communications Project Manager Responsibilities:

1. Assume responsibility for overall telecommunications system integration and coordination of work among trades, subcontractors, and authorized system installers.
2. Coordinate with related work indicated on drawings or specified.
3. Manage work related to telecommunications system installation in a manner approved by manufacturer.

#### **1.7 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Provide parts list including quantity of spare parts.
- C. Provide manufacturer product information. Government reserves the right to require a list of installations where products have been in operation.
- D. Provide Source Quality Control Submittal:
  1. Submit written certification from OEM indicating that proposed supervisor of installation and proposed provider of warranty maintenance are authorized representatives of OEM. Include individual's legal name, contact information and OEM credentials in certification.
  2. Submit written certification from OEM that wiring and connection diagrams meet Government Life Safety Guidelines, NFPA, NEC, NRTL, these specifications, and Joint Commission requirements and instructions, requirements, recommendations, and guidance set forth by OEM for the proper performance of system.
  3. Pre-acceptance Certification: Certification in accordance with procedure outlined in Section 01 00 00, GENERAL REQUIREMENTS and specific Division 27 qualification documentation.
- E. Installer Qualifications: Submit three installations of similar size and complexity furnished and installed by installer; include:
  1. Installation location and name.
  2. Owner's name and contact information including, address, telephone and email.
  3. Date of project start and date of final acceptance.
  4. System project number.
  5. Three paragraph description of each system related to this project; include function, operation, and installation.
- F. Provide delegated design submittals (e.g. seismic support design).

- G. Submittals are required for all equipment anchors and supports. Include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion,) associated with equipment or conduit. Anchors and supports to resist seismic load based on seismic design categories per section 4.0 of VA seismic design requirements H-18-8 dated August, 2013.
- H. Test Equipment List:
1. Supply test equipment of accuracy better than parameters to be tested.
  2. Submit test equipment list including make and model number:
    - a. ANSI/TIA-1152 Level IIIe twisted pair cabling test instrument.
    - b. Fiber optic insertion loss power meter with light source.
    - c. Optical time domain reflectometer (OTDR).
    - d. Volt-Ohm meter.
    - e. Digital camera.
  3. Supply only test equipment with a calibration tag from Government-accepted calibration service dated not more than 12 months prior to test.
  4. Provide sample test and evaluation reports.
- I. Submittal Drawings:
1. Telecommunications Space Plans/Elevations: Provide enlarged floor plans of telecommunication spaces indicating layout of equipment and devices, including receptacles and grounding provisions. Submit detailed plan views and elevations of telecommunication spaces showing racks, termination blocks, and cable paths. Include following rooms:
    - a. Telecommunications rooms.
    - b. Building Entrance Facility/Demarcation rooms.
    - c. Server rooms/Data Center.
    - d. Equipment rooms.
    - e. Antenna Head End rooms.
  2. Logical Drawings: Provide logical riser or schematic drawings for all systems.
    - a. Provide riser diagrams systems and interconnection drawings for equipment assemblies; show termination points and identify wiring connections.

3. Access Panel Schedule on Submittal Drawings: Coordinate and prepare a location, size, and function schedule of access panels required to fully service equipment.

J. Provide sustainable design submittals.

K. Furnish electronic certified test reports to COR prior to final inspection and not more than 90 days after completion of tests.

#### **1.8 CLOSEOUT SUBMITTALS**

A. Provide following closeout submittals prior to project closeout date:

1. Warranty certificate.
2. Evidence of compliance with requirements such as low voltage certificate of inspection.
3. Project record documents.
4. Instruction manuals and software that are a part of system.

B. Maintenance and Operation Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

1. Prepare a manual for each system and equipment specified.
2. Furnish on portable storage drive in PDF format or equivalent accepted by COR.
3. Furnish complete manual as specified in specification section, fifteen days prior to performance of systems or equipment test.
4. Furnish remaining manuals prior to final completion.
5. Identify storage drive "MAINTENANCE AND OPERATION MANUAL" and system name.
6. Include name, contact information and emergency service numbers of each subcontractor installing system or equipment and local representatives for system or equipment.
7. Provide a Table of Contents and assemble files to conform to Table of Contents.
8. Operation and Maintenance Data includes:
  - a. Approved shop drawing for each item of equipment.
  - b. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of equipment.
  - c. A control sequence describing start-up, operation, and shutdown.
  - d. Description of function of each principal item of equipment.
  - e. Installation and maintenance instructions.
  - f. Safety precautions.
  - g. Diagrams and illustrations.

- h. Test Results and testing methods.
  - i. Performance data.
  - j. Pictorial "exploded" parts list with part numbers. Emphasis to be placed on use of special tools and instruments. Indicate sources of supply, recommended spare parts, and name of servicing organization.
  - k. Warranty documentation indicating end date and equipment protected under warranty.
  - l. Appendix; list qualified permanent servicing organizations for support of equipment, including addresses and certified personnel qualifications.
- C. Record Wiring Diagrams:
- 1. Red Line Drawings: Keep one E size 91.44 cm x 121.92 cm (36 inches x 48 inches) set of floor plans, on site during work hours, showing installation progress marked and backbone cable labels noted. Make these drawings available for examination during construction meetings or field inspections.
  - 2. General Drawing Specifications: Detail and elevation drawings to be D size 61 cm x 91.44 cm (24 inches x 36 inches) with a minimum scale of 0.635 cm = 30.48 cm (1/4 inch = 12 inches). ER, TR and other enlarged detail floor plan drawings to be D size 61 cm x 91.44 cm (24" x 36") with a minimum scale of 0.635 cm = 30.48 cm (1/4 inch = 12 inches). Building composite floor plan drawings to be D size 61 cm x 91.44 cm (24 inches x 36 inches) with a minimum scale of 3.175 mm = 30.48 cm (1/8 inch = 1' 0 inch).
  - 3. Building Composite Floor Plans: Provide building floor plans showing work area outlet locations and configuration, types of jacks, distance for each cable, and cable routing locations.
  - 4. Floor plans to include:
    - a. Final room numbers and actual backbone cabling and pathway locations and labeling.
    - b. Inputs and outputs of equipment identified according to labels installed on cables and equipment
    - c. Device locations with labels.
    - d. Conduit.
    - e. Head-end equipment.
    - f. Wiring diagram.

- g. Labeling and administration documentation.
- 5. Submit Record Wiring Diagrams within five business days after final cable testing.
- 6. Deliver Record Wiring Diagrams as CAD files in .dwg or formats as determined by COR.
- 7. Deliver four complete sets of electronic record wiring diagrams to COR on portable storage drive.
- D. Service Qualifications: Submit name and contact information of service organizations providing service to this installation within four hours of receipt of notification service is needed.

#### **1.9 MAINTENANCE MATERIAL SUBMITTALS**

- A. After approval and prior to installation, furnish COR with the following:
  - 1. A 300 mm (12 inch) length of each type and size of wire and cable along with tag from coils of reels from which samples were taken.
  - 2. One coupling, bushing and termination fitting for each type of conduit.
  - 3. Samples of each hanger, clamp and supports for conduit and pathways.
  - 4. Duct sealing compound.

#### **1.10 QUALITY ASSURANCE**

- A. Manufacturer's Qualifications: Manufacturer must produce, as a principal product, the equipment and material specified for this project, and have manufactured item for at least three years.
- B. Product and System Qualification:
  - 1. OEM must have three installations of equipment submitted presently in operation of similar size and type as this project, that have continuously operated for a minimum of three years.
  - 2. Government reserves the right to require a list of installations where products have been in operation before approval.
  - 3. Authorized representative of OEM must be responsible for design, satisfactory operation of installed system, and certification.
- C. Trade Contractor Qualifications: Trade contractor must have completed three or more installations of similar systems of comparable size and complexity with regards to coordinating, engineering, testing, certifying, supervising, training, and documentation. Identify these installations as a part of submittal.

- D. System Supplier Qualifications: System supplier must be authorized by OEM to warranty installed equipment.
- E. Telecommunications technicians assigned to system must be trained, and certified by OEM on installation and testing of system; provide written evidence of current OEM certifications for installers.
- F. Manufactured Products:
  - 1. Comply with FAR clause 52.236-5 for material and workmanship.
  - 2. When more than one unit of same class of equipment is required, units must be product of a single manufacturer.
  - 3. Equipment Assemblies and Components:
    - a. Components of an assembled unit need not be products of same manufacturer.
    - b. Manufacturers of equipment assemblies, which include components made by others, to assume complete responsibility for final assembled unit.
    - c. Provide compatible components for assembly and intended service.
    - d. Constituent parts which are similar must be product of a single manufacturer.
  - 4. Identify factory wiring on equipment being furnished and on wiring diagrams.
- G. Testing Agencies: Government reserves the option of witnessing factory tests. Notify COR minimum 15 working days prior to manufacturer performing the factory tests.
  - 1. When equipment fails to meet factory test and re-inspection is required, contractor is liable for additional expenses, including expenses of Government.

#### **1.11 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery and Acceptance Requirements:
  - 1. Government's approval of submittals must be obtained for equipment and material before delivery to job site.
  - 2. Deliver and store materials to job site in OEM's original unopened containers, clearly labeled with OEM's name and equipment catalog numbers, model and serial identification numbers for COR to inventory cable, patch panels, and related equipment.
- B. Storage and Handling Requirements:
  - 1. Equipment and materials must be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:

- a. Store and protect equipment in a manner that precludes damage or loss, including theft.
  - b. Protect painted surfaces with factory installed removable heavy kraft paper, sheet vinyl or equivalent.
  - c. Protect enclosures, equipment, controls, controllers, circuit protective devices, and other like items, against entry of foreign matter during installation; vacuum clean both inside and outside before testing and operating.
- C. Coordinate storage.

#### **1.12 FIELD CONDITIONS**

- A. Where variations from documents are requested in accordance with GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, connecting work and related components must include additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.
- B. A contract adjustment or additional time will not be granted because of field conditions pursuant to FAR 52.236-2 and FAR 52.236-3; a contract adjustment or additional time will not be granted for additional work required for complete and usable construction and systems pursuant to FAR 52.246-12.

#### **1.13 WARRANTY**

- A. Comply with FAR clause 52.246-21

### **PART 2 - PRODUCTS**

#### **2.1 PERFORMANCE AND DESIGN CRITERIA**

- A. Provide communications spaces and pathways conforming to TIA 569, at a minimum.

#### **2.2 EQUIPMENT IDENTIFICATION**

- A. Provide laminated black phenolic resin with a white core nameplates with minimum 6 mm (1/4 inch) high engraved lettering.
- B. Nameplates furnished by manufacturer as standard catalog items, unless other method of identification is indicated.

#### **2.3 UNDERGROUND WARNING TAPE**

- A. Underground Warning: Standard 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type; red with black letters imprinted with "CAUTION BURIED ELECTRIC LINE BELOW", orange with black letters imprinted with "CAUTION BURIED TELEPHONE LINE BELOW" or orange with black letters imprinted with "CAUTION BURIED FIBER OPTIC LINE BELOW", as applicable.



#### **2.4 WIRE LUBRICATING COMPOUND**

- A. Provide non-hardening or forming adhesive coating cable lubricants suitable for cable jacket material and raceway.

#### **2.5 FIREPROOFING TAPE**

- A. Provide flexible, conformable fabric tape of organic composition and coated one side with flame-retardant elastomer.
- B. Tape must be self-extinguishing and cannot support combustion; arc-proof and fireproof.
- C. Tape cannot deteriorate when subjected to water, gases, salt water, sewage, or fungus; and tape must be resistant to sunlight and ultraviolet light.
- D. Application must withstand a 200-ampere arc for minimum 30 seconds.
- E. Securing Tape: Glass cloth electrical tape minimum 0.18 mm (7 mils) thick and 19 mm (3/4 inch) wide.

#### **2.6 NOT USED**

#### **2.7 NOT USED**

#### **2.8 NOT USED**

#### **2.9 ACCESS PANELS**

- A. Panels: 304 mm x 304 mm (12 inches by 12 inches), or size allowed by location to provide optimum access to equipment for maintenance and service.
- B. Provide access panels and doors as required to allow service of materials and equipment that require inspection, replacement, repair or service.
- C. Provide access panels where items installed require access and are concealed in floor, wall, furred space or above ceiling; ceilings consisting of lay-in or removable splined tiles do not require access panels.
- D. Provide access panels with same fire rating classification as surface penetrated.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Penetrations and Sleeves:
  - 1. Lay out penetration and sleeve openings in advance, to permit provision in work.
  - 2. Set sleeves in forms before concrete is poured.

3. Set sleeves prior to installation of structure for passage of pipes, conduit, ducts, etc.
  4. Provide sleeves and packing materials at penetrations of foundations, walls, slabs, partitions, and floors.
  5. Make sleeves that penetrate outside walls, basement slabs, footings, and beams waterproof.
  6. Fill slots, sleeves and other openings in floors or walls if not used.
    - a. Fill spaces in openings after installation of conduit or cable.
    - b. Provide fill for floor penetrations to prevent passage of water, smoke, fire, and fumes.
    - c. Provide fire resistant fill in rated floors and walls, to prevent passage of air, smoke and fumes.
  7. Install sleeves through floors watertight and extend minimum 50.8 mm (2 inches) above floor surface.
  8. Match and set sleeves flush with adjoining floor, ceiling, and wall finishes where raceways passing through openings are exposed in finished rooms.
  9. Annular space between conduit and sleeve must be minimum 6 mm (1/4 inch).
  10. Do not provide sleeves for slabs-on-grade, unless specified or indicated otherwise.
  11. Comply with requirements for firestopping, for sleeves through rated fire walls and smoke partitions.
  12. Do not support piping risers or conduit on sleeves.
  13. Identify unused sleeves and slots for future installation.
  14. Provide core drilling if walls are poured or otherwise constructed without sleeves and wall penetration is required; do not penetrate structural members.
- B. Core Drilling:
1. Avoid core drilling whenever possible.
  2. Coordinate openings with other trades and utilities, and prevent damage to structural reinforcement.
  3. Investigate existing conditions in vicinity of required opening prior to coring, including an x-ray of floor if determined necessary by competent person or COR.
  4. Protect areas from damage.

C. Verification of In-Place Conditions:

1. Verify location, use and status of all material, equipment, and utilities that are specified, indicated, or determined necessary for removal.
  - a. Verify materials, equipment, and utilities to be removed are inactive, not required, or in use after completion of project.
  - b. Replace with equivalent any material, equipment and utilities that were removed by contractor that are required to be left in place.
2. Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under following conditions and then only after arranging to provide temporary utility services, according to requirements indicated:
  - a. Notify COR in writing at least 14 days in advance of proposed utility interruptions.
  - b. Do not proceed with utility interruptions without Government's written permission.

D. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs for floor, wall and ceiling mounting of equipment as required.

E. Provide steel supports and hardware for installation of hangers, anchors, guides, and other support hardware.

F. Obtain and analyze catalog data, weights, and other pertinent data required for coordination of equipment support provisions and installation.

G. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly that would void warranty.

**3.2 INSTALLATION - GENERAL**

A. Coordinate systems, equipment, and materials installation with other building components.

B. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings.

C. Conform to VAAR 852.236.91 arrangements indicated, recognizing that work may be shown in diagrammatic form or have been impracticable to detail all items because of variances in manufacturers' methods of achieving specified results.

- D. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed in both exposed and un-exposed spaces.
- E. Install equipment according to manufacturers' written instructions.
- F. Install wiring and cabling between equipment and related devices.
- G. Install cabling, wiring, and equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum interference of adjacent other installations.
- H. Provide access panel or doors where units are concealed behind finished surfaces.
- I. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for wiring, cabling, and equipment installations.
- J. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide maximum headroom and access for service and maintenance as possible.
- K. Install systems, materials, and equipment giving priority to systems required to be installed at a specified slope.
- L. Avoid interference with structure and with work or other trades, preserving adequate headroom and clearing doors and passageways to satisfaction of COR and code requirements.
- M. Install equipment and cabling to distribute equipment loads on building structural members provided for equipment support under other sections; install and support roof-mounted equipment on structural steel or roof curbs as appropriate.
- N. Provide supplementary or miscellaneous items, appurtenances, devices and materials for a complete installation.

### **3.3 EQUIPMENT INSTALLATION**

- A. Locate equipment as close as practical to locations shown on drawings.
- B. Note locations of equipment requiring access on record drawings.
- C. Access and Access Panels: Verify access panel locations and construction with COR.
- D. Inaccessible Equipment:
  - 1. Where Government determines that contractor has installed equipment not conveniently accessible for operation and maintenance, equipment

- must be removed and reinstalled as directed and without additional cost to Government.
2. Refer to Section 27 11 00, TELECOMMUNICATIONS ROOM FITTINGS for communication equipment cabinet assembly.
  3. Refer to Section 27 11 00, TELECOMMUNICATIONS ROOM FITTINGS for equipment labeling.

#### **3.4 EQUIPMENT IDENTIFICATION**

- A. Install an identification sign which clearly indicates information required for use and maintenance of equipment.
- B. Secure identification signs with screws.

#### **3.5 CUTTING AND PATCHING**

- A. Perform cutting and patching according to contract general requirements and as follows:
  1. Remove samples of installed work as specified for testing.
  2. Perform cutting, fitting, and patching of equipment and materials required to uncover existing infrastructure in order to provide access for correction of improperly installed existing or new work.
  3. Remove and replace defective work.
  4. Remove and replace non-conforming work.
- B. Cut, remove, and legally dispose of selected equipment, components, and materials, including removal of material, equipment, devices, and other items indicated to be removed and items made obsolete by new work.
- C. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.
- D. Protect adjacent installations during cutting and patching operations.
- E. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- F. Patch finished surfaces and building components using new materials specified for original installation and experienced installers.

#### **3.6 FIELD QUALITY CONTROL**

- A. Provide work according to VAAR 852.236.91 and FAR clause 52.236-5.
- B. Provide minimum clearances and work required for compliance with NFPA 70, National Electrical Code (NEC), and manufacturers' instructions; comply with additional requirements indicated for access and clearances.
- C. Verify all field conditions and dimensions that affect selection and provision of materials and equipment, and provide any disassembly,

reassembly, relocation, demolition, cutting and patching required to provide work specified or indicated, including relocation and reinstallation of existing wiring and equipment.

1. Protect facility, equipment, and wiring from damage.

D. Submit written notice that:

1. Project has been inspected for compliance with documents.

2. Work has been completed in accordance with documents.

E. Non-Conforming Work: Conduct project acceptance inspections, final completion inspections, substantial completion inspections, and acceptance testing and demonstrations after verification of system operation and completeness by Contractor.

F. For project acceptance inspections, final completion inspections, substantial completion inspections, and testing/demonstrations that require more than one site visit by COR or design professional to verify project compliance for same material or equipment, Government reserves right to obtain compensation from contractor to defray cost of additional site visits that result from project construction or testing deficiencies and incompleteness, incorrect information, or non-compliance with project provisions.

1. COR will notify contractor, of hourly rates and travel expenses for additional site visits, and will issue an invoice to Contractor for additional site visits.

2. Contractor is not be eligible for extensions of project schedule or additional charges resulting from additional site visits that result from project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions.

G. Tests:

1. Interim inspection is required at approximately 50 percent of installation.

2. Request inspection ten working days prior to interim inspection start date by notifying COR in writing; this inspection must verify equipment and system being provided adheres to installation, mechanical and technical requirements of construction documents.

3. Inspection to be conducted by OEM and factory-certified contractor representative, and witnessed by COR, facility and SMCS 0050P2H3 representatives.

4. Check each item of installed equipment to ensure appropriate NRTL listing labels and markings are fixed in place.
5. Verify cabling terminations in DEMARC, MCR, TER, SCC, ECC, TRs and head end rooms, workstation locations and TCO adhere to color code for pin assignments and cabling connections are in compliance with TIA standards.
6. Visually confirm minimum cable marking at TCOs, CCSs locations, patch cords and origination locations.
7. Review entire communications circulating ground system, each TGB and grounding connection, grounding electrode and outside lightning protection system.
8. Review cable tray, conduit and path/wire way installation practice.
9. OEM and contractor to perform:
  - a. Fiber optical cable field inspection tests via attenuation measurements on factory reels; provide results along with OEM certification for factory reel tests.
  - b. Coaxial cable field inspection tests via attenuation measurements on factory reels; provide results along with OEM certification for factory reel tests.
  - c. Baseband cable field inspection tests via attenuation measurements on factory reels and provide results along with OEM certification for factory reel tests.
10. Relocate failed cable reels to a secured location for inventory, as directed by COR, and then remove from project site within two working days; provide COR with written confirmation of defective cable reels removal from project site.
11. Provide results of interim inspections to COR.
12. If major or multiple deficiencies are discovered, additional interim inspections could be required until deficiencies are corrected, before permitting further system installation.
  - a. Additional inspections are scheduled at direction of COR.
  - b. Re-inspection of deficiencies noted during interim inspections, must be part of system's Final Acceptance Proof of Performance Test.
  - c. The interim inspection cannot affect the system's completion date unless directed by COR.

13. Facility COR will ensure test documents become a part of system's official documentation package.
- H. Pretesting: Re-align, re-balance, sweep, re-adjust and clean entire system and leave system working for a "break-in" period, upon completing installation of system and prior to Final Acceptance Proof of Performance Test. System RF transmitting equipment must not be connected to keying or control lines during "break-in" period.
1. Pretesting Procedure:
    - a. Verify systems are fully operational and meet performance requirements, utilizing accepted test equipment and spectrum analyzer.
    - b. Pretest and verify system functions and performance requirements conform to construction documents and, that no unwanted physical, aural and electronic effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise are present.
  2. Measure and record signal, aural and control carrier levels of each DAS RF, voice and data channel, at each of the following minimum points in system:
  3. Provide recorded system pretest measurements and certification that the system is ready for formal acceptance test to COR.
- I. Acceptance Test:
1. Schedule an acceptance test date after system has been pretested, and pretest results and certification submitted to COR.
  2. Give COR fifteen working days written notice prior to date test is expected to begin; include expected duration of time for test in notification.
  3. Test in the presence of the following:
    - a. COR.
    - b. OEM representatives.
    - c. VACO:
      - 1) CFM representative.
      - 2) AHJ-SMCS 0050P2H3, (202)461-5310.
    - d. VISN-CIO, Network Officer and VISN representatives.
    - e. Facility:
      - 1) FMS Service Chief, Bio-Medical Engineering and facility representatives.
      - 2) OI&T Service Chief and OI&T representatives.



- 3) Safety Officer, Police Chief and facility safety representatives.
  - f. Local Community Safety Personnel:
    - 1) Fire Marshal representative.
    - 2) Disaster Coordinator representative.
    - 3) EMS Representatives: Police, Sherriff, City, County or State representatives.
  4. Test system utilizing accepted test equipment to certify proof of performance and Life and Public Safety compliance, FCC, NRTL, NFPA and OSHA compliance.
    - a. Rate system as acceptable or unacceptable at conclusion of test; make only minor adjustments and connections required to show proof of performance.
      - 1) Demonstrate and verify that system complies with performance requirements under operating conditions.
      - 2) Failure of any part of system that precludes completion of system testing, and which cannot be repaired within four hours, terminates acceptance test of that portion of system.
      - 3) Repeated failures that result in a cumulative time of eight hours to affect repairs is cause for entire system to be declared unacceptable.
      - 4) If system is declared unacceptable, retesting must be rescheduled at convenience of Government and costs borne by the contractor.
- J. Acceptance Test Procedure:
1. Physical and Mechanical Inspection: The test team representatives must tour major areas to determine system and sub-systems are completely and properly installed and are ready for acceptance testing.
  2. A system inventory including available spare parts must be taken at this time.
  3. Each item of installed equipment must be re-checked to ensure appropriate NRTL (i.e. UL) certification listing labels are affixed.
  4. Confirm that deficiencies reported during Interim Inspections and Pretesting are corrected prior to start of Acceptance Test.
  5. Inventory system diagrams, record drawings, equipment manuals, pretest results.

6. Failure of system to meet installation requirements of specifications is grounds for terminating testing and to schedule re-testing.

K. Operational Test:

1. Individual Item Test: VACO AHJ representative (SMCS 0050P2H3) may select individual items of equipment for detailed proof of performance testing until 100 percent of system has been tested and found to meet requirements of the construction documents.
2. Government's Condition of Acceptance of System Language:
  - a. Without Acceptance: Until system fully meets conditions of construction documents, system's ownership, use, operation and warranty commences at Government's final acceptance date.
  - b. With Conditional Acceptance: Stating conditions that need to be addressed by contractor or OEM and stating system's use and operation to commence immediately while its warranty commences only at Government's agreed final extended acceptance date.
  - c. With Full Acceptance: Stating system's ownership, use, operation and warranty to immediately commence at Government's agreed to date of final acceptance.

L. Acceptance Test Conclusion: Reschedule testing on deficiencies and shortages with COR, after COR and SMCS AHJ jointly agree to results of the test, using the generated punch list or discrepancy list. Perform retesting to comply with these specifications at contractor's expense.

M. Proof of Performance Certification:

1. If system is declared acceptable, AHJ (SMCS 0050P2H3) provides COR notice stating system processes to required operating standards and functions and is Government accepted for use by facility.
2. Validate items with COR needing to be provided to complete project contract (i.e. charts & diagrams, manuals, spare parts, system warranty documents executed, etc.). Once items have been provided, COR contacts FMS service chief to turn over system from CFM oversight for beneficial use by facility.
3. If system is declared unacceptable without conditions, rescheduled testing expenses are to be borne by contractor.

### 3.7 CLEANING

- A. Remove debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from project site and clean work area, prior to final inspection and acceptance of work.
- B. Put building and premises in neat and clean condition.
- C. Remove debris on a daily basis.
- D. Remove unused material, during progress of work.
- E. Perform cleaning and washing required to provide acceptable appearance and operation of equipment to satisfaction of COR.
- F. Clean exterior surface of all equipment, including concrete residue, dirt, and paint residue, after completion of project.
- G. Perform final cleaning prior to project acceptance by COR.
- H. Remove paint splatters and other spots, dirt, and debris; touch up scratches and mars of finish to match original finish.
- I. Clean devices internally using methods and materials recommended by manufacturer.
- J. Tighten wiring connectors, terminals, bus joints, and mountings, to include lugs, screws and bolts according to equipment manufacturer's published torque tightening values for equipment connectors. In absence of published connection or terminal torque values, comply with torque values specified in UL 486A-486B.

### 3.8 TRAINING

- A. Provide training in accordance with subsection, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.
- B. Provide training for equipment or system as required in each associated specification.
- C. Develop and submit training schedule for approval by COR, at least 30 days prior to planned training.

### 3.9 PROTECTION

- A. Protection of Fireproofing:
  - 1. Install clips, hangers, clamps, supports and other attachments to surfaces to be fireproofed, if possible, prior to start of spray fireproofing work.
  - 2. Install conduits and other items that would interfere with proper application of fireproofing after completion of spray fire proofing work.

3. Patch and repair fireproofing damaged due to cutting or course of work must be performed by installer of fireproofing and paid for by trade responsible for damage.
- B. Maintain equipment and systems until final acceptance.
- C. Ensure adequate protection of equipment and material during installation and shutdown and during delays pending final test of systems and equipment because of seasonal conditions.

- - - E N D - - -

**SECTION 28 05 13**  
**CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the finishing, installation, connection, testing and certification the conductors and cables required for a fully functional for electronic safety and security (ESS) system.

**1.2 RELATED WORK**

- A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.
- B. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- C. Section 28 05 28.33 - CONDUITS AND BOXES FOR ELECTRONIC SECURITY AND SAFETY. Requirements for infrastructure.

**1.3 DEFINITIONS**

- A. BICSI: Building Industry Consulting Service International.
- B. EMI: Electromagnetic interference.
- C. IDC: Insulation displacement connector.
- D. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- F. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
- G. RCDD: Registered Communications Distribution Designer.
- H. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.
- I. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.
- J. UTP: Unshielded twisted pair.

**1.4 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

1. Manufacturer's Literature and Data: Showing each cable type and rating.
2. Certificates: Two weeks prior to final inspection, deliver to the COR four copies of the certification that the material is in accordance with the drawings and specifications and diagrams for cable management system.
3. Shop Drawings: Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
  - a. Vertical and horizontal offsets and transitions.
  - b. Clearances for access above and to side of cable trays.
  - c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
  - d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.
  - e. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 2 and 3.
4. Wiring Diagrams. Show typical wiring schematics including the following:
  - a. Workstation outlets, jacks, and jack assemblies.
  - b. Patch cords.
  - c. Patch panels.
5. Cable Administration Drawings: As specified in Part 3 "Identification" Article.
6. Project planning documents as specified in Part 3.
7. Maintenance Data: For wire and cable to include in maintenance manuals.

#### **1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by the basic designation only.
- B. American Society of Testing Material (ASTM):  
D2301-04.....Standard Specification for Vinyl Chloride  
Plastic Pressure Sensitive Electrical Insulating  
Tape
- C. Federal Specifications (Fed. Spec.):

A-A-59544-08.....Cable and Wire, Electrical (Power, Fixed  
Installation)

D. National Fire Protection Association (NFPA):

70-11.....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):

44-05.....Thermoset-Insulated Wires and Cables

83-08.....Thermoplastic-Insulated Wires and Cables

467-07.....Electrical Grounding and Bonding Equipment

486A-03.....Wire Connectors and Soldering Lugs for Use with  
Copper Conductors

486C-04.....Splicing Wire Connectors

486D-05.....Insulated Wire Connector Systems for Underground  
Use or in Damp or Wet Locations

486E-00.....Equipment Wiring Terminals for Use with Aluminum  
and/or Copper Conductors

493-07.....Thermoplastic-Insulated Underground Feeder and  
Branch Circuit Cable

514B-04.....Fittings for Cable and Conduit

**PART 2 - PRODUCTS**

**2.1 GENERAL**

A. General: All cabling locations shall be in conduit systems as outlined in Division 28 unless a waiver is granted in writing or an exception is noted on the construction drawings.

B. Cable Trays:

1. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by [electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick] [hot-dip galvanizing, complying with ASTM A 123/A 123M Grade 0.55, not less than 0.002165 inch (0.055 mm) thick].

2. Basket Cable Trays: [6 inches (150 mm) wide and 2 inches (50 mm) deep]. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).

3. Trough Cable Trays: [Nominally 6 inches (150 mm)] <Insert dimension> wide.

4. Ladder Cable Trays: [Nominally 18 inches (455 mm)] <Insert dimension> wide, and a rung spacing of [12 inches (305 mm)] <Insert spacing>.

5. Channel Cable Trays: One-piece construction, [nominally 4 inches (100 mm)] <Insert dimension> wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
  6. Solid-Bottom Cable Trays: One-piece construction, [nominally 12 inches (305 mm)] <Insert dimension> wide. Provide [with] [without] solid covers.
- C. Conduit and Boxes: Comply with requirements in Division 28 Section "Conduits and Backboxes for Electrical Systems." [Flexible metal conduit shall not be used.]
1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

## 2.2 BACKBOARDS

- A. Backboards: Plywood, [fire-retardant treated,] 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry".

## 2.3 UTP CABLE

- A. Description: 100-ohm, 4-pair UTP, formed into 25-pair binder groups covered with a blue thermoplastic jacket.
1. Comply with ICEA S-90-661 for mechanical properties.
  2. Comply with TIA/EIA-568-B.1 for performance specifications.
  3. Comply with TIA/EIA-568-B.2, [Category 5e] [Category 6].
  4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
    - a. Communications, General Purpose: Type CM or CMG [; or MPP, CMP, MPR, CMR, MP, or MPG].
    - b. Communications, Plenum Rated: Type CMP [; or MPP], complying with NFPA 262.
    - c. Communications, Riser Rated: Type CMR [; or MPP, CMP, or MPR], complying with UL 1666.
    - d. Communications, Limited Purpose: Type CMX[; or MPP, CMP, MPR, CMR, MP, MPG, CM, or CMG].
    - e. Multipurpose: Type MP or MPG [; or MPP or MPR].
    - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
    - g. Multipurpose, Riser Rated: Type MPR [or MPP], complying with UL 1666.



#### 2.4 UTP CABLE HARDWARE

- A. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.
- B. Connecting Blocks: [110-style for Category 5e] [110-style for Category 6] [66-style for Category 5e]. Provide blocks for the number of cables terminated on the block, plus [25] <Insert percentage> percent spare. Integral with connector bodies, including plugs and jacks where indicated.

#### 2.5 OPTICAL FIBER CABLE

- A. Description: Multimode, [50/125] [62.5/125]-micrometer, [24] <Insert number>-fiber, [nonconductive,] tight buffer, optical fiber cable.
  - 1. Comply with ICEA S-83-596 for mechanical properties.
  - 2. Comply with TIA/EIA-568-B.3 for performance specifications.
  - 3. Comply with [TIA/EIA-492AAAA-B] [TIA/EIA-492AAAA-A] for detailed specifications.
  - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
    - a. General Purpose, Nonconductive: Type OFN or OFNG [, or OFNR, OFNP].
    - b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
    - c. Riser Rated, Nonconductive: Type OFNR [or OFNP], complying with UL 1666.
    - d. General Purpose, Conductive: Type OFC or OFCG [; or OFNG, OFN, OFCR, OFNR, OFCP, or OFNP].
    - e. Plenum Rated, Conductive: Type OFCP [ or OFNP], complying with NFPA 262.
    - f. Riser Rated, Conductive: Type OFCR [; or OFNR, OFCP, or OFNP], complying with UL 1666.
  - 5. Conductive cable shall be [steel] [aluminum] armored type.
  - 6. Maximum Attenuation: [3.50] <Insert number> dB/km at 850 nm; [1.5] <Insert number> dB/km at 1300 nm.
  - 7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
- B. Jacket:
  - 1. Jacket Color: [Aqua for 50/125-micrometer cable] [Orange for 62.5/125-micrometer cable].

2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

## **2.6 OPTICAL FIBER CABLE HARDWARE**

- A. Cable Connecting Hardware: Meet the Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
  1. Quick-connect, simplex and duplex, [Type SC] [Type ST] [Type LC] [Type MT-RJ] connectors. Insertion loss shall be not more than 0.75 dB.
  2. Type SFF connectors may be used in termination racks, panels, and equipment packages.

## **2.7 COAXIAL CABLE**

- A. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
- B. RG-11/U: NFPA 70, Type CATV.
  1. No. 14 AWG, solid, copper-covered steel conductor.
  2. Gas-injected, foam-PE insulation.
  3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
  4. Jacketed with sunlight-resistant, black PVC or PE.
  5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
- C. RG59/U: NFPA 70, Type CATVR.
  1. No. 20 AWG, solid, silver-plated, copper-covered steel conductor.
  2. Gas-injected, foam-PE insulation.
  3. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
  4. Color-coded PVC jacket.
- D. RG-6/U: NFPA 70, Type CATV or CM.
  1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
  2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
  3. Jacketed with black PVC or PE.

4. Suitable for indoor installations.
- E. RG59/U: NFPA 70, Type CATV.
1. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
  2. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
  3. PVC jacket.
- F. RG59/U (Plenum Rated): NFPA 70, Type CMP.
1. No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
  2. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
  3. Copolymer jacket.
- G. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655, and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
1. CATV Cable: Type CATV[, or CATVP or CATVR].
  2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
  3. CATV Riser Rated: Type CATVR[; or CATVP, CATVR, or CATV], complying with UL 1666.
  4. CATV Limited Rating: Type CATVX.

## **2.8 COAXIAL CABLE HARDWARE**

- A. Coaxial-Cable Connectors: Type BNC, 75 ohms.

## **2.9 RS-232 CABLE**

- A. Standard Cable: NFPA 70, Type CM.
1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
  2. Polypropylene insulation.
  3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
  4. PVC jacket.
  5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
  6. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
  2. Plastic insulation.

3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

#### **2.10 RS-485 CABLE**

- A. Standard Cable: NFPA 70, Type CM[ or CMG].
  1. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
  2. PVC insulation.
  3. Unshielded.
  4. PVC jacket.
  5. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated Cable: NFPA 70, Type CMP.
  1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
  2. Fluorinated ethylene propylene insulation.
  3. Unshielded.
  4. Fluorinated ethylene propylene jacket.
  5. Flame Resistance: NFPA 262, Flame Test.

#### **2.11 LOW-VOLTAGE CONTROL CABLE**

- A. Paired Lock Cable: NFPA 70, Type CMG.
  1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
  2. PVC insulation.
  3. Unshielded.
  4. PVC jacket.
  5. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.
  1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
  2. PVC insulation.
  3. Unshielded.
  4. PVC jacket.
  5. Flame Resistance: Comply with NFPA 262.
- C. Paired Lock Cable: NFPA 70, Type CMG.
  1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.

2. PVC insulation.
  3. Unshielded.
  4. PVC jacket.
  5. Flame Resistance: Comply with UL 1581.
- D. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.
1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
  2. Fluorinated ethylene propylene insulation.
  3. Unshielded.
  4. Plastic jacket.
  5. Flame Resistance: NFPA 262, Flame Test.

#### **2.12 CONTROL-CIRCUIT CONDUCTORS**

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.
- B. Class 2 Control Circuits: Stranded copper, [Type THHN-THWN, in raceway] [power-limited cable, concealed in building finishes] [power-limited tray cable, in cable tray] complying with UL 83.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

#### **2.13 FIRE ALARM WIRE AND CABLE**

- A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- B. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG].
  1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.
- C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
  1. Low-Voltage Circuits: No. 16 AWG, minimum.
  2. Line-Voltage Circuits: No. 12 AWG, minimum.
  3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor [with outer jacket] with red identifier stripe, NRTL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

**2.14 IDENTIFICATION PRODUCTS**

- A. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

**2.15 SOURCE QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
- E. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
- F. Cable will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

**2.16 WIRE LUBRICATING COMPOUND**

- A. Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.
- B. Shall not be used on wire for isolated type electrical power systems.

**2.17 FIREPROOFING TAPE**

- A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.
- B. The tape shall be self-extinguishing and shall not support combustion. It shall be arc-proof and fireproof.
- C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.
- D. The finished application shall withstand a 200-ampere arc for not less than 30 seconds.
- E. Securing tape: Glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19 mm (3/4 inch) wide.

**PART 3 - EXECUTION**

**3.1 INSTALLATION OF CONDUCTORS AND CABLES**

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Comply with TIA/EIA-568-B.1.

2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
9. Pulling Cable:
  - a. Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
  - b. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
  - c. Use ropes made of nonmetallic material for pulling feeders.
  - d. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the COR.
  - e. Pull in multiple cables together in a single conduit.
- C. Splice cables and wires where necessary only in outlet boxes, junction boxes, or pull boxes.
  1. Splices and terminations shall be mechanically and electrically secure.
  2. Where the Government determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Government.

- D. Seal cable and wire entering a building from underground, between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.
- E. Unless otherwise specified in other sections install wiring and connect to equipment/devices to perform the required functions as shown and specified.
- F. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.
- G. Where separate power supply circuits are not shown, connect the systems to the nearest panel boards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.
- H. Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.
- I. System voltages shall be 120 volts or lower where shown on the drawings or as required by the NEC.
- J. UTP Cable Installation:
  - 1. Comply with TIA/EIA-568-B.2.
  - 2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
- K. Optical Fiber Cable Installation:
  - 1. Comply with TIA/EIA-568-B.3.
  - 2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.
- L. Open-Cable Installation:
  - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  - 2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than [60 inches (1525 mm)] <Insert dimension> apart.
  - 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- M. Installation of Cable Routed Exposed under Raised Floors:
  - 1. Install plenum-rated cable only.
  - 2. Install cabling after the flooring system has been installed in raised floor areas.



3. Coil cable [72 inches (1830 mm)] <Insert size> long shall be neatly coiled not less than [12 inches (300 mm)] <Insert size> in diameter below each feed point.

N. Outdoor Coaxial Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.
2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).

O. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).

- c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
- 5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
- 6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

### **3.2 FIRE ALARM WIRING INSTALLATION**

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal raceway according to Division 28 Section CONDUITS AND BACKBOXES FOR ELECTRICAL SYSTEMS."
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
  - 2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
- C. Wiring Method:
  - 1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
  - 2. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is[ not] permitted.
  - 3. Signaling Line Circuits: Power-limited fire alarm cables [may] [shall not] be installed in the same cable or raceway as signaling line circuits.
- D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-

indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

- G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- H. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

### **3.3 CONTROL CIRCUIT CONDUCTORS**

- A. Minimum Conductor Sizes:
  - 1. Class 1 remote-control and signal circuits, No. 14 AWG.
  - 2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
  - 3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

### **3.4 CONNECTIONS**

- A. Comply with requirements in Division 28 Section "FIRE DETECTION AND ALARM" for connecting, terminating, and identifying wires and cables.

### **3.5 FIRESTOPPING**

- A. Comply with TIA/EIA-569-A, "Firestopping" Annex A.
- B. Comply with BICSI TDMM, "Firestopping Systems" Article.

### **3.6 GROUNDING**

- A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. For low-voltage wiring and cabling, comply with requirements in Division 28 Section "GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY."

### **3.7 IDENTIFICATION**

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.
- B. Install a permanent wire marker on each wire at each termination.
- C. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
- D. Wire markers shall retain their markings after cleaning.
- E. In each handhole, install embossed brass tags to identify the system served and function.

### 3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  - 1. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
  - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  - 3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.
    - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
  - 4. Optical Fiber Cable Tests:
    - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
    - b. Link End-to-End Attenuation Tests:
      - 1) Multimode Link Measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
      - 2) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
  - 5. Coaxial Cable Tests: Comply with requirements in Division 27 Section "Master Antenna Television System."
- D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a

guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

**3.9 EXISTING WIRING**

A. Unless specifically indicated on the plans, existing wiring shall not be reused for the new installation. Only wiring that conforms to the specifications and applicable codes may be reused. If existing wiring does not meet these requirements, existing wiring may not be reused and new wires shall be installed.

- - - E N D - - -

**SECTION 28 05 26**  
**GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the finishing, installation, connection, testing and certification of the grounding and bonding required for a fully functional Electronic Safety and Security (ESS) system.
- B. "Grounding electrode system" refers to all electrodes required by NEC, as well as including made, supplementary, grounding electrodes.
- C. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning

**1.2 RELATED WORK**

- A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.
- B. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for low voltage power and lighting wiring.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 01 00 00 - GENERAL REQUIREMENTS
- B. Shop Drawings:
  - 1. Clearly present enough information to determine compliance with drawings and specifications.
  - 2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
- C. Test Reports: Provide certified test reports of ground resistance.
- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the COR:
  - 1. Certification that the materials and installation are in accordance with the drawings and specifications.
  - 2. Certification by the contractor that the complete installation has been properly installed and tested.

**1.4 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American Society for Testing and Materials (ASTM):

- B1-07.....Standard Specification for Hard-Drawn Copper Wire
- B3-07.....Standard Specification for Soft or Annealed Copper Wire
- B8-04.....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - 81-1983.....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
  - C2-07.....National Electrical Safety Code
- D. National Fire Protection Association (NFPA):
  - 70-11.....National Electrical Code (NEC)
  - 99-2005.....Health Care Facilities
- E. Underwriters Laboratories, Inc. (UL):
  - 44-05 .....Thermoset-Insulated Wires and Cables
  - 83-08 .....Thermoplastic-Insulated Wires and Cables
  - 467-07 .....Grounding and Bonding Equipment
  - 486A-486B-03 .....Wire Connectors

**PART 2 - PRODUCTS**

**2.1 GROUNDING AND BONDING CONDUCTORS**

- A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes 6 mm<sup>2</sup> (10 AWG) and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 25 mm<sup>2</sup> (4 AWG) and larger shall be permitted to be identified per NEC.
- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 6 mm<sup>2</sup> (10 AWG) and smaller shall be ASTM B1 solid bare copper wire.

**2.2 GROUND RODS**

- A. Copper clad steel, 19 mm (3/4-inch) diameter by 3000 mm (10 feet) long, conforming to UL 467.
- B. Quantity of rods shall be as required to obtain the specified ground resistance.

### **2.3 SPLICES AND TERMINATION COMPONENTS**

- A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).2.4 ground connections
- B. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- C. Below Grade: Exothermic-welded type connectors.
- D. Above Grade:
  - 1. Bonding Jumpers: Compression-type connectors, using zinc-plated fasteners and external tooth lockwashers.
  - 2. Connection to Building Steel: Exothermic-welded type connectors.
  - 3. Ground Busbars: Two-hole compression type lugs, using tin-plated copper or copper alloy bolts and nuts.
  - 4. Rack and Cabinet Ground Bars: One-hole compression-type lugs, using zinc-plated or copper alloy fasteners.
  - 5. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
    - a) Pipe Connectors: Clamp type, sized for pipe.
  - 6. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

### **2.4 EQUIPMENT RACK AND CABINET GROUND BARS**

- A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 4 mm thick by 19 mm wide (3/8 inch x ¾ inch).

### **2.5 GROUND TERMINAL BLOCKS**

- A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

### **2.6 SPLICE CASE GROUND ACCESSORIES**

- A. Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 16 mm<sup>2</sup> (6 AWG) insulated ground wire with shield bonding connectors.

### **2.7 COMPUTER ROOM GROUND**

- A. Provide 50mm<sup>2</sup> (1/0 AWG) bare copper grounding conductors bolted at mesh intersections to form an equipotential grounding grid. The



equipotential grounding grid shall form a 600mm (24 inch) mesh pattern.  
The grid shall be bonded to each of the access floor pedestals.

## **2.8 SECURITY CONTROL ROOM GROUND**

- A. Provide 50mm<sup>2</sup> (1/0 AWG) stranded copper grounding conductor(s) color coded with a green jacket, bolted at the Room's Communications System Grounding Electrode Cooper Plate and circulate to each equipment rack ground buss bar through the wire management system. Connect each equipment rack, wire management system's cable tray, ladder, etc. to the circulating ground wire with a minimum 25mm<sup>2</sup> (4AWG) stranded Cooper Wire, color coded with a green jacket.
  - 1. Connect each equipment rack ground buss bar to the circulating ground wire as indicated in 2.9.A, and
  - 2. Connect each additional room item to the circulating ground wire as indicated in 2.9.A.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Ground in accordance with the NEC, as shown on drawings, and as specified herein.
- B. System Grounding:
  - 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
  - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- C. Equipment Grounding: Metallic structures, including ductwork and building steel, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

### **3.2 INACCESSIBLE GROUNDING CONNECTIONS**

- A. Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

### **3.3 CORROSION INHIBITORS**

- A. When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

### **3.4 CONDUCTIVE PIPING**

- A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

### **3.5 COMPUTER ROOM/SECURITY EQUIPMENT ROOM GROUNDING**

- A. Conduit: Ground and bond metallic conduit systems as follows:
1. Ground metallic service conduit and any pipes entering or being routed within the computer room at each end using 16 mm<sup>2</sup> (6AWG) bonding jumpers.
  2. Bond at all intermediate metallic enclosures and across all joints using 16 mm<sup>2</sup> (6 AWG) bonding jumpers.

### **3.6 WIREWAY GROUNDING**

- A. Ground and Bond Metallic Wireway Systems as follows:
1. Bond the metallic structures of wireway to provide 100 percent electrical continuity throughout the wireway system by connecting a 16 mm<sup>2</sup> (6 AWG) bonding jumper at all intermediate metallic enclosures and across all section junctions.
  2. Install insulated 16 mm<sup>2</sup> (6 AWG) bonding jumpers between the wireway system bonded as required in paragraph 1 above, and the closest building ground at each end and approximately every 16 meters (50 feet).
  3. Use insulated 16 mm<sup>2</sup> (6 AWG) bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and cross all section junctions.
  4. Use insulated 16 mm<sup>2</sup> (6 AWG) bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 meters.

### **3.7 NOT USED**

### **3.8 NOT USED**

### **3.9 GROUND RESISTANCE**

- A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.
- B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical

distribution system is energized and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- C. Services at power company interface points shall comply with the power company ground resistance requirements.
- D. Below-grade connections shall be visually inspected by the COR prior to backfilling. The contractor shall notify the COR 24 hours before the connections are ready for inspection.

### **3.10 GROUND ROD INSTALLATION**

- A. Drive each rod vertically in the earth, not less than 3000 mm (10 feet) in depth.
- B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.
- C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

### **3.11 LABELING**

- A. Comply with requirements in Division 26 Section "ELECTRICAL IDENTIFICATION" Article for instruction signs. The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer
  - 1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

### **3.12 NOT USED**

### **3.13 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal at individual ground rods. Make tests at ground rods before any conductors are connected.
  - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
  - b. Perform tests by fall-of-potential method according to IEEE 81.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
  1. Power Distribution Units or Panel boards Serving Electronic Equipment: 3 ohm(s).
  2. Manhole Grounds: 10 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

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**SECTION 28 05 28.33**  
**CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the finishing, installation, connection, testing certification of the conduit, fittings, and boxes to form a complete, coordinated, raceway system(s). Conduits and when approved separate UL Certified and Listed partitioned telecommunications raceways are required for a fully functional Electronic Safety and Security (ESS) system. Raceways are required for all electronic safety and security cabling unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

**1.2 RELATED WORK**

- A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.
- B. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

**1.3 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. FMC: Flexible metal conduit.
- E. IMC: Intermediate metal conduit.
- F. LFMC: Liquidtight flexible metal conduit.
- G. LFNC: Liquidtight flexible nonmetallic conduit.
- H. NBR: Acrylonitrile-butadiene rubber.
- I. RNC: Rigid nonmetallic conduit.

**1.4 NOT USED**

**1.5 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Furnish the following:
- B. Shop Drawings:
  - 1. Size and location of main feeders;
  - 2. Size and location of panels and pull boxes
  - 3. Layout of required conduit penetrations through structural elements.
  - 4. The specific item proposed and its area of application shall be identified on the catalog cuts.

- C. Certification: Prior to final inspection, deliver to the COR four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.
- D. NOT APPLICABLE
- E. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- F. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Custom enclosures and cabinets.
  - 2. Handholes and boxes for underground wiring, including the following:
    - a. Duct entry provisions, including locations and duct sizes.
    - b. Frame and cover design.
    - c. Grounding details.
    - d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
    - e. Joint details.
- G. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Structural members in the paths of conduit groups with common supports.
  - 2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

**1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. National Electrical Manufacturers Association (NEMA):
  - TC-3-04.....PVC Fittings for Use with Rigid PVC Conduit and Tubing
  - FB1-07.....Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
- C. National Fire Protection Association (NFPA):
  - 70-11.....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
  - 1-05.....Flexible Metal Conduit
  - 5-04.....Surface Metal Raceway and Fittings

6-07.....	Rigid Metal Conduit
50-07.....	Enclosures for Electrical Equipment
360-09.....	Liquid-Tight Flexible Steel Conduit
467-07.....	Grounding and Bonding Equipment
514A-04.....	Metallic Outlet Boxes
514B-04.....	Fittings for Cable and Conduit
514C-02.....	Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
651-05.....	Schedule 40 and 80 Rigid PVC Conduit
651A-07.....	Type EB and A Rigid PVC Conduit and HDPE Conduit
797-07.....	Electrical Metallic Tubing
1242-06.....	Intermediate Metal Conduit

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Conduit Size: In accordance with the NEC, but not less than 20 mm (3/4 inch) unless otherwise shown.

**2.2.CONDUIT**

- A. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.
- B. Rigid aluminum: Shall Conform to UL 6A, ANSI C80.5.
- C. Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.
- D. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 volts or less.
- E. Flexible galvanized steel conduit: Shall Conform to UL 1.
- F. Liquid-tight flexible metal conduit: Shall Conform to UL 360.
- G. Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).

**2.3.WIREWAYS AND RACEWAYS**

- A. Surface metal raceway: Shall Conform to UL 5.

**2.4.CONDUIT FITTINGS**

- A. Rigid steel and IMC conduit fittings:
  - 1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
  - 2. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
  - 3. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.

4. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
  5. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
  6. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
- B. Rigid aluminum conduit fittings:
1. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
  2. Locknuts and bushings: As specified for rigid steel and IMC conduit.
  3. Set screw fittings: Not permitted for use with aluminum conduit.
- C. Electrical metallic tubing fittings:
1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
  2. Only steel or malleable iron materials are acceptable.
  3. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller. Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
  4. Indent type connectors or couplings are prohibited.
  5. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
- D. Flexible steel conduit fittings:
1. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
  2. Clamp type, with insulated throat.
- E. Liquid-tight flexible metal conduit fittings:



1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
2. Only steel or malleable iron materials are acceptable.
3. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

F. Direct burial plastic conduit fittings:

1. Fittings shall meet the requirements of UL 514C and NEMA TC3.
2. As recommended by the conduit manufacturer.

G. Surface metal raceway fittings: As recommended by the raceway manufacturer.

H. Expansion and deflection couplings:

1. Conform to UL 467 and UL 514B.
2. Accommodate, 19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
3. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
4. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

## 2.5 CONDUIT SUPPORTS

- A. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
- B. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
- C. Multiple conduit (trapeze) hangers: Not less than 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3/8 inch) diameter steel hanger rods.
- D. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

## 2.6 OUTLET, JUNCTION, AND PULL BOXES

- A. UL-50 and UL-514A.
- B. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
- C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- D. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.
- E. Sheet metal boxes: Galvanized steel, except where otherwise shown.
- F. Flush mounted wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall.

Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.

## **2.7 CABINETS**

- A. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
- B. Hinged door in front cover with flush latch and concealed hinge.
- C. Key latch to match panelboards.
- D. Metal barriers to separate wiring of different systems and voltage.
- E. Accessory feet where required for freestanding equipment.

## **2.8 WIREWAYS**

- A. Equip with hinged covers, except where removable covers are shown.

## **2.9 NOT USED**

## **2.10 NOT USED**

## **2.11 NOT USED**

## **2.12 NOT USED**

## **2.13 NOT USED**

## **PART 3 - EXECUTION**

### **3.1 PENETRATIONS**

- A. Cutting or Holes:
  - 1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the COR prior to drilling through structural sections.
  - 2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the COR as required by limited working space.
- B. Fire Stop: Where conduits, wireways, and other electronic safety and security raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

### **3.2 INSTALLATION, GENERAL**

- A. Install conduit as follows:
  - 1. In complete runs before pulling in cables or wires.
  - 2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.

3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
  4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
  5. Mechanically continuous.
  6. Independently support conduit at 2.4 m (8 foot) on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).
  7. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.
  8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
  9. Conduit installations under fume and vent hoods are prohibited.
  10. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
  11. NOT USED
  12. Do not use aluminum conduits in wet locations.
  13. Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors and ceilings.
- B. Conduit Bends:
1. Make bends with standard conduit bending machines.
  2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
  3. Bending of conduits with a pipe tee or vise is prohibited.
- C. Layout and Homeruns:
1. Install conduit with wiring, including homeruns, as shown.
  2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the COR.
- D. Fire Alarm:
1. Fire alarm conduit shall be painted red (a red "top-coated" conduit from the conduit manufacturer may be used in lieu of painted conduit) in accordance with the requirements of Section 28 31 00, "FIRE DETECTION AND ALARM".

### 3.3 CONCEALED WORK INSTALLATION

#### A. In Concrete:

1. Conduit: Rigid steel, IMC or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only when the following occurs:
  - a. Where shown on the structural drawings.
  - b. As approved by the COR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
4. Installation of conduit in concrete that is less than 75 mm (3 inch) thick is prohibited.
  - a. Conduit outside diameter larger than 1/3 of the slab thickness is prohibited.
  - b. Space between conduits in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.
  - c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (3/4 inch) of concrete around the conduits.
5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the conduits. Tightening set screws with pliers is prohibited.

#### B. Furred or Suspended Ceilings and in Walls:

1. Conduit for conductors above 600 volts:
  - a. Rigid steel or rigid aluminum.
  - b. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
2. Conduit for conductors 600 volts and below:
  - a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.
3. Align and run conduit parallel or perpendicular to the building lines.
4. Connect recessed lighting fixtures to conduit runs with maximum 1800 mm (6 feet) of flexible metal conduit extending from a junction box to the fixture.
5. Tightening set screws with pliers is prohibited.

### **3.4 EXPOSED WORK INSTALLATION**

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- B. Conduit for Conductors 600 volts and below:
  - 1. Rigid steel, IMC, rigid aluminum, or EMT. Different type of conduits mixed indiscriminately in the system is prohibited.
- C. Align and run conduit parallel or perpendicular to the building lines.
- D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- E. Support horizontal or vertical runs at not over 2400 mm (eight foot) intervals.
- F. Surface metal raceways: Use only where shown.

### **3.5 NOT USED**

### **3.6 CONDUIT SUPPORTS, INSTALLATION**

- A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other approved fasteners.
- D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
  - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
  - 2. Existing Construction:
    - a. Steel expansion anchors not less than 6 mm (1/4 inch) bolt size and not less than 28 mm (1-1/8 inch) embedment.
    - b. Power set fasteners not less than 6 mm (1/4 inch) diameter with depth of penetration not less than 75 mm (3 inches).
    - c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
- F. Hollow Masonry: Toggle bolts are permitted.
- G. Bolts supported only by plaster or gypsum wallboard are not acceptable.
- H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

- I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- K. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.
- L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

### **3.7 BOX INSTALLATION**

- A. Boxes for Concealed Conduits:
  - 1. Flush mounted.
  - 2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.
- C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
- D. Outlet boxes in the same wall mounted back-to-back are prohibited. A minimum 600 mm (24 inch), center-to-center lateral spacing shall be maintained between boxes).
- E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 100 mm (4 inches) square by 55 mm (2-1/8 inches) deep, with device covers for the wall material and thickness involved.
- F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1".
- G. On all Branch Circuit junction box covers, identify the circuits with black marker.

### **3.8 ELECTRONIC SAFETY AND SECURITY CONDUIT**

- A. Install the electronic safety and security raceway system as shown on drawings.
- B. Minimum conduit size of 19 mm (3/4 inch), but not less than the size shown on the drawings.
- C. All conduit ends shall be equipped with insulated bushings.
- D. All 100 mm (four inch) conduits within buildings shall include pull boxes after every two 90 degree bends. Size boxes per the NEC.

- E. Vertical conduits/sleeves through closets floors shall terminate not less than 75 mm (3 inches) below the floor and not less than 75 mm (3 inches) below the ceiling of the floor below.
- F. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.
- G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.
- H. All empty conduits located in communications closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.
- I. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of communication conduit bends shall be as follows (special long radius):

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
$\frac{3}{4}$	150 (6)
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

- J. Furnish and install 19 mm (3/4 inch) thick fire retardant plywood specified in on the wall of communication closets where shown on drawings . Mount the plywood with the bottom edge 300 mm (one foot) above the finished floor.
- K. Furnish and pull wire in all empty conduits. (Sleeves through floor are exceptions).

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**SECTION 28 31 00**  
**FIRE DETECTION AND ALARM**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section of the specifications includes the furnishing, installation, and connection of fire alarm equipment to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices and wiring as shown on the drawings and specified. The fire alarm system shall not be combined with other systems such as building automation, energy management, security, etc.
- B. Fire alarm systems shall comply with requirements of the most recent VA FIRE PROTECTION DESIGN MANUAL and NFPA 72 unless variations to NFPA 72 are specifically identified within these contract documents by the following notation: "variation". The design, system layout, document submittal preparation, and supervision of installation and testing shall be provided by a technician that is certified NICET level III or a registered fire protection engineer. The NICET certified technician shall be on site for the supervision and testing of the system. Factory engineers from the equipment manufacturer, thoroughly familiar and knowledgeable with all equipment utilized, shall provide additional technical support at the site as required by the COR or his authorized representative. Installers shall have a minimum of 2 years experience installing fire alarm systems.

**1.2 SCOPE**

- A. Modifications to the existing addressable fire alarm system shall be designed and installed in accordance with the specifications and drawings. Device location and wiring runs shown on the drawings are for reference only unless specifically dimensioned. Actual locations shall be in accordance with NFPA 72 and this specification.
- B. All existing fire alarm equipment, wiring, devices and sub-systems that are not shown to be reused shall be removed. All existing fire alarm conduit not reused shall be removed.
- C. Basic Performance:
  - 1. Initiating device circuits (IDC) shall be wired Style C in accordance with NFPA 72.



### 1.3 RELATED WORK

- A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.  
Requirements for procedures for submittals.
- B. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.
- C. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.
- D. Section 28 05 28.33 - CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.

### 1.4 SUBMITTALS

- A. General: Submit 5 copies in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
- B. Drawings:
  - 1. Prepare drawings using AutoCAD software and include all contractors information. Layering shall be by VA criteria as provided by the COR. The contractor shall be responsible for verifying all critical dimensions shown on the drawings provided by VA.
- C. Manuals:
  - 1. Submit simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets for all items used in the system, power requirements, device wiring diagrams, dimensions, and information for ordering replacement parts.
    - a. Wiring diagrams shall have their terminals identified to facilitate installation, operation, expansion and maintenance.
    - b. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.
    - c. Include complete listing of all software used and installation and operation instructions including the input/output matrix chart.
    - d. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate, inspect, test and maintain the equipment and system. Provide all manufacturer's installation limitations including but not limited to circuit length limitations.
    - e. Complete listing of all digitized voice messages.

- f. Provide standby battery calculations under normal operating and alarm modes. Battery calculations shall include the magnets for holding the doors open for one minute.
  - g. Include information indicating who will provide emergency service and perform post contract maintenance.
  - h. Provide a replacement parts list with current prices. Include a list of recommended spare parts, tools, and instruments for testing and maintenance purposes.
  - i. A computerized preventive maintenance schedule for all equipment. The schedule shall be provided on disk in a computer format acceptable to the VAMC and shall describe the protocol for preventive maintenance of all equipment. The schedule shall include the required times for systematic examination, adjustment and cleaning of all equipment. A print out of the schedule shall also be provided in the manual. Provide the disk in a pocket within the manual.
  - j. Furnish manuals in 3 ring loose-leaf binder or manufacturer's standard binder.
  - k. A print out for all devices proposed on each signaling line circuit with spare capacity indicated.
2. Two weeks prior to final inspection, deliver 4 copies of the final updated maintenance and operating manual to the COR.
- a. The manual shall be updated to include any information necessitated by the maintenance and operating manual approval.
  - b. Complete "As installed" wiring and schematic diagrams shall be included that shows all items of equipment and their interconnecting wiring. Show all final terminal identifications.
  - c. Complete listing of all programming information, including all control events per device including an updated input/output matrix.
  - d. Certificate of Installation as required by NFPA 72 for each building. The certificate shall identify any variations from the National Fire Alarm Code.
  - e. Certificate from equipment manufacturer assuring compliance with all manufacturers installation requirements and satisfactory system operation.

D. Certifications:

1. Together with the shop drawing submittal, submit the technician's NICET level III fire alarm certification as well as certification from the control unit manufacturer that the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include in the certification the names and addresses of the proposed supervisor of installation and the proposed performer of contract maintenance. Also include the name and title of the manufacturer's representative who makes the certification.
2. Together with the shop drawing submittal, submit a certification from either the control unit manufacturer or the manufacturer of each component (e.g., smoke detector) that the components being furnished are compatible with the control unit.
3. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer that the wiring and connection diagrams meet this specification, UL and NFPA 72 requirements.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by the basic designation only and the latest editions of these publications shall be applicable.
- B. National Fire Protection Association (NFPA):
- NFPA 13 .....Standard for the Installation of Sprinkler Systems, 2010 edition
  - NFPA 14 .....Standard for the Installation of Standpipes and Hose Systems, 2010 edition
  - NFPA 20 .....Standard for the Installation of Stationary Pumps for Fire Protection, 2010 edition
  - NFPA 70.....National Electrical Code (NEC), 2010 edition
  - NFPA 72.....National Fire Alarm Code, 2010 edition
  - NFPA 90A.....Standard for the Installation of Air Conditioning and Ventilating Systems, 2009 edition
  - NFPA 101.....Life Safety Code, 2009 edition
- C. Underwriters Laboratories, Inc. (UL): Fire Protection Equipment Directory

- D. Factory Mutual Research Corp (FM): Approval Guide, 2007-2011
- E. American National Standards Institute (ANSI):  
S3.41.....Audible Emergency Evacuation Signal, 1990  
edition, reaffirmed 2008
- F. International Code Council, International Building Code (IBC), 2009  
edition

**PART 2 PRODUCTS**

**2.1 EQUIPMENT AND MATERIALS, GENERAL**

- A. All equipment and components shall be new and the manufacturer's current model. All equipment shall be tested and listed by Underwriters Laboratories, Inc. or Factory Mutual Research Corporation for use as part of a fire alarm system. The authorized representative of the manufacturer of the major equipment shall certify that the installation complies with all manufacturers' requirements and that satisfactory total system operation has been achieved.

**2.2 CONDUIT, BOXES, AND WIRE**

- A. Conduit shall be in accordance with Section 28 05 28.33 CONDUIT AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY and as follows:
  - 1. All new conduits shall be installed in accordance with NFPA 70.
  - 2. Conduit fill shall not exceed 40 percent of interior cross sectional area.
  - 3. All new conduits shall be 3/4 inch (19 mm) minimum.
- B. Wire:
  - 1. Wiring shall be in accordance with NEC article 760, Section 28 05 13, CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY, and as recommended by the manufacturer of the fire alarm system. All wires shall be color coded. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG for initiating device circuits and 14 AWG for notification device circuits.
  - 2. Addressable circuits and wiring used for the multiplex communication loop shall be twisted and shielded unless specifically excepted by the fire alarm equipment manufacturer in writing.
  - 3. Any fire alarm system wiring that extends outside of a building shall have additional power surge protection to protect equipment from physical damage and false signals due to lightning, voltage and current induced transients. Protection devices shall be shown on the

submittal drawings and shall be UL listed or in accordance with written manufacturer's requirements.

4. All wire or cable used in underground conduits including those in concrete shall be listed for wet locations.

C. Terminal Boxes, Junction Boxes, and Cabinets:

1. Shall be galvanized steel in accordance with UL requirements.
2. All boxes shall be sized and installed in accordance with NFPA 70.
3. covers shall be repainted red in accordance with Section 09 91 00, PAINTING and shall be identified with white markings as "FA" for junction boxes and as "FIRE ALARM SYSTEM" for cabinets and terminal boxes. Lettering shall be a minimum of 3/4 inch (19 mm) high.
4. Terminal boxes and cabinets shall have a volume 50 percent greater than required by the NFPA 70. Minimum sized wire shall be considered as 14 AWG for calculation purposes.
5. Terminal boxes and cabinets shall have identified pressure type terminal strips and shall be located at the base of each riser. Terminal strips shall be labeled as specified or as approved by the COR.

**2.3 ALARM INITIATING DEVICES**

A. Manual Fire Alarm Stations:

1. Shall be non-breakglass, address reporting type.
2. Station front shall be constructed of a durable material such as cast or extruded metal or high impact plastic. Stations shall be semi-flush type.
3. Stations shall be of single action pull down type with suitable operating instructions provided on front in raised or depressed letters, and clearly labeled "FIRE."
4. Operating handles shall be constructed of a durable material. On operation, the lever shall lock in alarm position and remain so until reset. A key shall be required to gain front access for resetting, or conducting tests and drills.
5. Unless otherwise specified, all exposed parts shall be red in color and have a smooth, hard, durable finish.

**PART 3 - EXECUTION**

**3.1 INSTALLATION:**

- A. Installation shall be in accordance with NFPA 70, 72, 90A, and 101 as shown on the drawings, and as recommended by the major equipment

- manufacturer. Fire alarm wiring shall be installed in conduit. All conduit and wire shall be installed in accordance with, Section 28 05 13 CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY, Section 28 05 26 GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY, Section 28 05 28.33 CONDUIT AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY,
- B. All conduits, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas.
  - C. All new and reused exposed conduits shall be painted to match surrounding finished areas and red in unfinished areas.
  - D. All existing accessible fire alarm conduit not reused shall be removed.
  - F. All fire detection and alarm system devices, control units and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas. Exact locations are to be approved by the COR.
  - G. Manual pull stations shall be installed not less than 42 inches (1,050 mm) or more than 48 inches (1,200 mm) from finished floor to bottom of device and within 60 inches (1,500 mm) of a stairway or an exit door.

### **3.2 TYPICAL OPERATION**

- A. Revisions to the existing system shall be made to function in the same manner as is currently in place.

### **3.3 TESTS (OF NEW AND REVISED WORK)**

- A. Provide the service of a NICET level III, competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests of the new work. Make all adjustments and tests in the presence of the COR.
- B. When the systems have been completed and prior to the scheduling of the final inspection, furnish testing equipment and perform the following tests in the presence of the COR. When any defects are detected, make repairs or install replacement components, and repeat the tests until such time that the complete fire alarm systems meets all contract requirements. After the system has passed the initial test and been approved by the COR, the contractor may request a final inspection.
  - 1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

2. Test the insulation on all installed cable and wiring by standard methods as recommended by the equipment manufacturer.
3. Open each alarm initiating and notification circuit to see if trouble signal actuates.
4. Ground each alarm initiation and notification circuit and verify response of trouble signals.

#### **3.4 FINAL INSPECTION AND ACCEPTANCE**

- A. Prior to final acceptance a minimum 30 day "burn-in" period shall be provided. The purpose shall be to allow equipment to stabilize and potential installation and software problems and equipment malfunctions to be identified and corrected. During this diagnostic period, all system operations and malfunctions shall be recorded. Final acceptance will be made upon successful completion of the "burn-in" period and where the last 14 days is without a system or equipment malfunction.
- B. At the final inspection a factory trained representative of the manufacturer of the major equipment shall repeat the tests in Article 3.3 TESTS and those required by NFPA 72. In addition the representative shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of a VA representative.

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