DEPARTMENT OF VETERANS AFFAIRS
VHA MASTER SPECIFICATIONS

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SECTION 00 01 15
LIST OF DRAWING SHEETS

The drawings listed below accompanying this specification form a part of the contract.

Drawing No.	Title
GI001	COVER SHEET
GI002	GENERAL NOTES, SYMBOLS, AND ABBREVIATIONS
GI003	PHASING PLAN
GC001	CONCEPTUAL ELEVATOR ELEVATION
GC600	ELEVATOR SCOPE SHEET
GC700	TEMPORARY SIGNAGE
1E-GC100	EMERGENCY EGRESS
1E-GC101	ICRA
1E-AE100	BLDG / PIT PLAN
1E-AE101	ELEVATOR SE-3 FLOOR PLAN
1E-AE102	ELEVATOR SE1 / SE-2 FLOOR PLAN
1E-AE103	ELEVATOR SE-1 / SE-2 MACHINE ROOM
1E-AE104	ELEVATOR SE-3 MACHINE ROOM
1E-AE200	CAB ELEVATIONS
1E-AE900	ELEVATOR SE-1/SE-2/SE-3 LOBBIES
22-GC100	EMERGENCY EGRESS, ICRA, AND SAFETY
22-HA100	ELEVATOR ABATEMENT PLAN
22-AE100	ELEVATOR PIT FLOOR / ELEVATION PLAN
22-AE101	FLOOR PLAN
22-AE200	CAB ELEVATIONS
22-AE900	PHOTOGRAPHS
28-GC100	EMERGENCY EGRESS, ICRA, AND SAFETY
28-HA100	ELEVATOR ABATEMENT PLAN
28-AE100	ELEVATOR PIT FLOOR / ELEVATION PLAN
28-AE200	CAB ELEVATIONS
28-AE900	PHOTOGRAPHS
P-001	PLUMBING LEGEND, GENERAL NOTES, ABBREVIATIONS AND SCHEDULES
P-501	PLUMBING DETAILS
1E-PP101	BUILDING 1E - PLUMBING PLAN
22-PP102	BUILDING 22 - PLUMBING PLAN
28-PP103	BUILDING 28 - PLUMBING PLAN
M-001	MECHANICAL LEGEND, GENERAL NOTES, AND ABBREVIATIONS

M-501	MECHANICAL DETAILS
M-601	MECHANICAL SCHEDULES / CONTROLS
22-MD101	BUILDING 22 - MECHANICAL DEMOLITION PLAN
22-MH101	BUILDING 22 - MECHANICAL PLAN
28-MH102	BUILDING 28 - MECHANICAL PLAN
E-001	ELECTRICAL LEGEND, GENERAL NOTES, AND ABBREVIATIONS
E-501	ELECTRICAL DETAILS AND MOTOR CONTROL CENTER ELEVATIONS
E-502	TRANSFORMER GROUNDING DETAIL
EL501	LIGHT FIXTURE SCHEDULE, LIGHT FIXTURE CUT SHEET, AND LIGHTING CALCULATIONS
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EP601	ELECTRICAL PANEL SCHEDULES AND TRANSFORMER GROUNDING DETAIL
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1E.ED-102	ELECTRICAL DEMOLITION - BUILDING 1E - BASEMENT - EIGHTH FLOOR PLAN ELEVATOR SE3
1E.ED-103	ELECTRICAL DEMOLITION NINTH FLOOR PLAN - BUILDING 1E - ELEVATORS SE1 AND SE2
1E.ED-104	ELECTRICAL DEMOLITION PENTHOUSE FLOOR PLAN - BUILDING 1E - ELEVATOR SE3
22.ED-113	ELECTRICAL DEMOLITION BASEMENT, FIRST FLOOR AND SECOND FLOOR - BUILDING 22
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1E.EP-102	ELECTRICAL POWER - BUILDING 1E - BASEMENT - EIGHTH FLOOR PLAN - ELEVATOR SE3
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28.EP-118	ELECTRICAL POWER FIRST FLOOR PLAN - BUILDING 28
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SECTION 01 00 00
GENERAL REQUIREMENTS

GENERAL

1.1 SAFETY REQUIREMENTS

A. 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 structures, and furnish labor and materials and perform work for Refurbish D-Wing Elevator Fayetteville VA Medical Center. as required by drawings and specifications.

B. Visits to the site by Bidders may be made only by appointment with the Medical Center Engineering Officer

C. Offices of West Point Engineers, as Architect-Engineers, 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 his duly authorized representative.

D. 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. ITEM I, GENERAL CONSTRUCTION: BASE BID work includes general construction, demolition, and new construction necessary to execute plans and specifications. See drawings for phasing.

B. BASE BID:

1. 3 Traction Elevators S1, S2, and S3 in Bldg 1E.
2. 2 Hydraulic Elevators C1 and C2 in Bldg 28.

C. BID ADD ALTERNATE A: Add the following item to the base bid:

1. ADD 1 Hydraulic Elevator C3 in Bldg 28.

D. BID ADD ALTERNATE B: Add the following item to the base bid:

1. ADD 1 Holeless Elevator Bldg 22.

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.

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.
2. Before starting work the General Contractor shall give one week’s 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.
3. No photography of VA premises is allowed without written permission of the Contracting Officer. Patients and staff are not to be photographed at any time.
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.
5. The General Contractor shall install all permanent cores at completion of the work. See Section 08 71 00, DOOR HARDWARE and coordinate.

C. 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.

D. Motor Vehicle Restrictions
1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
2. A 2 permits shall be issued for General Contractor and its employees for parking in designated areas only. Contractor to coordinate with VA Medical Center Facility Manager.

1.6 OPERATIONS AND STORAGE AREAS (FAR 52.236-10)

A. The Contractor shall confine all operations (including storage of materials) 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. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

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 materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. 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.

D. Working space and space available for storing materials shall be as determined by the COR .

E. Workers are subject to rules of Medical Center applicable to their conduct.

F. 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.

G. 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.

H. 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 shall be demolished/removed back to the source.

I. Phasing:

1. 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 contractor shall perform work on up to 3 elevators at a time with the limitation of no more than 1 elevator per elevator bank at a time.
2. To ensure 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. Arrange such phasing dates to ensure accomplishment of this work in successive phases mutually agreeable to Medical Center Director, COR and Contractor, as follows:

Phase I:

Phase II:

J. Utilities Services: 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 COR.

1. 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 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.
2. Contractor shall submit a request to interrupt any such services to COR, in writing, 7 days in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
3. Contractor will be advised (in writing) of approval of request, or of which 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.
4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COR.
5. In case of a contract construction emergency, service will be interrupted on approval of COR. Such approval will be confirmed in writing as soon as practical.

6. 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 Government and not the Contractor.

K. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, shall be removed back to their source. There shall be no abandoned lines without prior and specific written approval of the COR.

L. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:

1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles.
2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COR.

M. Coordinate the work for this contract with other construction operations as directed by COR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

1.7 ALTERATIONS

A. 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).

B. 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 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (FAR 52.236-9)

A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workers, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound 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.

1.10 RESTORATION

A. Remove, cut, alter, 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 workers 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 "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

1.11 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 contract changes, modifications and clarifications.

B. All variations shall be shown in the same general detail as used in the contract drawings. To ensure 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.

1.12 WARRANTY MANAGEMENT

A. Warranty Management Plan: Develop a warranty management plan which contains information relevant to FAR 52.246-21 Warranty of Construction in at least 30 days before the planned pre-warranty conference, submit one set of the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the

Government receives all warranties to which it is entitled. The plan must be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesman, or of engineering background, not necessarily familiar with this contract. The term “status” as indicated below must include due date and whether item has been submitted or was approved. Warranty information made available during the construction phase must be submitted to the Contracting Officer for approval prior to each monthly invoice for payment. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period will begin on the date of the project acceptance and continue for the product warranty period. A joint 4 month and 9 month warranty inspection will be conducted, measured from time of acceptance, by the Contactor and the Contracting Officer. Include in the warranty management plan, but not limited to, the following:

1. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the company of the Contractor, subcontractors, manufacturers or suppliers involved.
2. Furnish with each warranty the name, address and telephone number of each of the guarantor’s representatives nearest project location.
3. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include HVAC balancing, pumps, motors, transformers and for all commissioned systems such as fire protection and alarm systems, etc.
4. A list for each warranted equipment item, feature of construction or system indicating:
   a. Name of item.
   b. Model and serial numbers.
   c. Location where installed.
   d. Name and phone numbers of manufacturers and suppliers.
   e. Name and phone numbers of manufacturers or suppliers.
   f. Names, addresses and phone numbers of sources of spare parts.
   g. Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have extended warranties must be indicated with separate warranty expiration dates.

h. Starting point and duration of warranty period.
i. Summary of maintenance procedures required to continue the warranty in force.
j. Cross-reference to specific pertinent Operation and Maintenance manuals.
k. Organizations, names and phone numbers of persons to call for warranty service.
l. Typical response time and repair time expected for various warranted equipment.

5. The plans for attendance at the 4 and 9-month post construction warranty inspections conducted by the government.
6. Procedure and status of tagging of all equipment covered by extended warranties.
7. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

B. Performance & Payment Bonds: The Performance & Payment Bonds must remain effective throughout the construction period

1. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.
2. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the contractor’s expenses, the Contracting Officer will have the right to recoup expenses from the bonding company.
3. Following oral or written notification of required construction warranty repair work, the Contractor shall respond in a timely manner. Written verification will follow oral instructions. Failure to respond will be cause for the Contracting Officer to proceed against the Contractor.

C. Contractor’s Response to Construction Warranty Service Requirements:

D. Following oral or written notification by the Contracting Officer, the Contractor shall respond to construction warranty service requirements in accordance with the “Construction Warranty Service Priority List”

and the three categories of priorities listed below. Submit a report on any warranty item that has been repaired during the warranty period. Include within the report the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframe specified, the Government will perform the work and back charge the construction warranty payment item established.

1. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.
2. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.
3. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.
4. The “Construction Warranty Service Priority List” is as follows:

   a) Code 1-Air Conditioning Systems
      1) Air conditioning leak in part of the building, if causing damage.
      2) Air conditioning system not cooling properly.
      1) Elevator cab doors or hardware, not functioning properly, causing security, fire or safety problem.
   b) Code 3-Doors
      1) Elevator cab doors not functioning properly.
   c) Code 1-Electrical
      1) Power failure (entire area or any building operational after 1600 hours).
      2) Security lights.
      3) Smoke detectors.
   d) Code 2-Electrical
      1) Power failure (no power to a room or part of building). Lights not operational elevators or shafts.
      2) Code 1-Heat
      1) Power failure affecting heat.
   e) Code 3-Interior
      1) Floors damaged.

2) Paint chipping or peeling.

3) Casework damaged.

f) Code 2-Water (Hot)

1) No hot water in portion of building listed.

g) Code 3

1) All work not listed above.

E. Warranty Tags: At the time of installation, tag each warranted item with a durable, oil and water-resistant tag approved by the Contracting Officer. Attach each tag with a copper wire and spray with a silicone waterproof coating. Also submit two record copies of the warranty tags showing the layout and design. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

Warranty Tags
Type of product/material
Model number
Serial number
Contract number
Warranty period from/to
Inspector’s signature
Construction Contractor
Address
Telephone number
Warranty Contact
Address
Telephone number
Warranty response time priority code

1.13 USE OF ROADWAYS

A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the COR, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed and restoration performed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or

similar construction, they must be protected by well-constructed bridges.

B. When certain buildings (or parts of certain buildings) are required to be completed in advance of general date of completion, all roads leading thereto must be completed and available for use at time set for completion of such buildings or parts thereof.

1.14 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.

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.

1.15 TEMPORARY USE OF EXISTING ELEVATORS

A. Use of existing elevators for handling building materials and Contractor's personnel will be permitted subject to following provisions:

1. Contractor covers and provides maximum protection of following elevator components:
   a) Entrance jambs, heads soffits and threshold plates.
   b) Entrance columns, canopy, return panels and inside surfaces of car enclosure walls.
   c) Finish flooring.
2. 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.

1.16 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).
2. Contractor shall cover and provide maximum protection of the entire elevator(s) installation.
3. All elevator(s) parts worn or damaged during temporary use shall be removed and replaced with new parts at the contractor’s 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.

1.17 AVAILABILITY AND USE OF UTILITY SERVICES

1.18 CONTRACTOR MAY TIE INTO AND UTILIZE ANY UTILITY SERVICES REQUIRED FOR THE PERFORMANCE OF THIS CONTRACT. COORDIANTE TIE-INS AND CONNECTIONS WITH THE COR.TESTS

A. As per specification section 23 05 93 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, feedwater, 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.

1.19 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.

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SECTION 01 32 16.15
PROJECT SCHEDULES
(SMALL PROJECTS – DESIGN/BID/BUILD)

PART 1- GENERAL

1.1 DESCRIPTION:

A. The Contractor shall develop a Critical Path Method (CPM) plan and schedule demonstrating fulfillment of the contract requirements (Project Schedule), and shall keep the Project Schedule up-to-date in accordance with the requirements of this section and shall utilize the plan for scheduling, coordinating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers). Conventional Critical Path Method (CPM) technique shall be utilized to satisfy both time and cost applications.

1.2 CONTRACTOR'S REPRESENTATIVE:

A. The Contractor shall designate an authorized representative responsible for the Project Schedule including preparation, review and progress reporting with and to the Contracting Officer's Representative (COTR).

B. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this specification section.

C. The Contractor’s representative shall have the option of developing the project schedule within their organization or to engage the services of an outside consultant. If an outside scheduling consultant is utilized, Section 1.3 of this specification will apply.

1.3 CONTRACTOR'S CONSULTANT:

A. The Contractor shall submit a qualification proposal to the COTR, within 10 days of bid acceptance. The qualification proposal shall include:

1. The name and address of the proposed consultant.
2. Information to show that the proposed consultant has the qualifications to meet the requirements specified in the preceding paragraph.
3. A representative sample of prior construction projects, which the proposed consultant has performed complete project scheduling services. These representative samples shall be of similar size and scope.

B. The Contracting Officer has the right to approve or disapprove the proposed consultant, and will notify the Contractor of the VA decision within seven calendar days from receipt of the qualification proposal. In case of disapproval, the Contractor shall resubmit another consultant within 10 calendar days for renewed consideration. The Contractor shall have their scheduling consultant approved prior to submitting any schedule for approval.

1.4 COMPUTER PRODUCED SCHEDULES

A. The contractor shall provide monthly, to the Department of Veterans Affairs (VA), all computer-produced time/cost schedules and reports generated from monthly project updates. This monthly computer service will include: three copies of up to five different reports (inclusive of all pages) available within the user defined reports of the scheduling software approved by the Contracting Officer; a hard copy listing of all project schedule changes, and associated data, made at the update and an electronic file of this data; and the resulting monthly updated schedule in PDM format. These must be submitted with and substantively support the contractor’s monthly payment request and the signed look ahead report. The COTR shall identify the five different report formats that the contractor shall provide.

B. The contractor shall be responsible for the correctness and timeliness of the computer-produced reports. The Contractor shall also responsible for the accurate and timely submittal of the updated project schedule and all CPM data necessary to produce the computer reports and payment request that is specified.

C. The VA will report errors in computer-produced reports to the Contractor’s representative within ten calendar days from receipt of reports. The Contractor shall reprocess the computer-produced reports and associated diskette(s), when requested by the Contracting Officer’s representative, to correct errors which affect the payment and schedule for the project.

D. The cloud-based management software (Basis of Design Procore) will manage the forecasted project schedule. The Contractor will assist the COR in setting up a 7, 30, and 60-day look ahead within the cloud-based management software. The COR can filter these looks ahead to see up to 6 VA-assigned departments and will allow the COR to print on 8 ½ x 11 paper.

E. The project schedule will show the Architect / Engineer site visits. Coordinate these dates with the COR and assign them as a resource “A/E” when Architect/Engineer involvement is required.

F. The project schedule and any filtered reports shall be printable by the COR.

G. The Contractor will update all progress on the schedule at the end of each week and shall update the cloud-based Procore schedule by 9AM on the first working day of each week. On the second working day of each week by 10 AM, the contractor will forward a PDF of the 30-day look ahead schedule. All tasks that have moved more than three days shall be identified by the scheduler’s report, and any date slippage affecting the next milestone or project ending date shall be highlighted, and the COR, The General Trades Contractor Project Manager, and the Project Scheduler shall discuss at the project teams weekly meeting.

1.5 THE COMPLETE PROJECT SCHEDULE SUBMITTAL

A. Within 45 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review; three blue line copies of the interim schedule on sheets of paper 30 x 42 inches and an electronic file in the previously approved CPM schedule program. The submittal shall also include three copies of a computer-produced activity/event ID schedule showing project duration; phase completion dates; and other data, including event cost. Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, activity/event description, duration, budget amount, early start date, early finish date, late start date, late finish date and total float. Work activity/event relationships shall be restricted to finish-to-start or start-to-start without lead or lag constraints. Activity/event date constraints, not required by the contract, will not be accepted unless submitted to and approved by the Contracting Officer. The contractor shall make a separate written detailed request to the Contracting Officer identifying these date constraints and secure the Contracting Officer’s written approval before incorporating them into the network diagram. The Contracting Officer’s separate approval of the Project

Schedule shall not excuse the contractor of this requirement. Logic events (non-work) will be permitted where necessary to reflect proper logic among work events, but must have zero duration. The complete working schedule shall reflect the Contractor's approach to scheduling the complete project. **The final Project Schedule in its original form shall contain no contract changes or delays which may have been incurred during the final network diagram development period and shall reflect the entire contract duration as defined in the bid documents.** These changes/delays shall be entered at the first update after the final Project Schedule has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time as a result of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

B. Within 30 calendar days after receipt of the complete project interim Project Schedule and the complete final Project Schedule, the Contracting Officer or his representative, will do one or both of the following:
   1. Notify the Contractor concerning his actions, opinions, and objections.
   2. A meeting with the Contractor at or near the job site for joint review, correction or adjustment of the proposed plan will be scheduled if required. Within 14 calendar days after the joint review, the Contractor shall revise and shall submit three blue line copies of the revised Project Schedule, three copies of the revised computer-produced activity/event ID schedule and a revised electronic file as specified by the Contracting Officer. The revised submission will be reviewed by the Contracting Officer and, if found to be as previously agreed upon, will be approved.

C. The approved baseline schedule and the computer-produced schedule(s) generated there from shall constitute the approved baseline schedule until subsequently revised in accordance with the requirements of this section.

D. The Complete Project Schedule shall contain approximately 200 work activities/events.

1.6 WORK ACTIVITY/EVENT COST DATA

A. The Contractor shall cost load all work activities/events except procurement activities. The cumulative amount of all cost loaded work activities/events (including alternates) shall equal the total contract price. Prorate overhead, profit and general conditions on all work activities/events for the entire project length. The contractor shall generate from this information cash flow curves indicating graphically the total percentage of work activity/event dollar value scheduled to be in place on early finish, late finish. These cash flow curves will be used by the Contracting Officer to assist him in determining approval or disapproval of the cost loading. Negative work activity/event cost data will not be acceptable, except on VA issued contract changes.

B. The Contractor shall cost load work activities/events for guarantee period services, test, balance and adjust various systems in accordance with the provisions in Article, FAR 52.232 – 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.232 –Article 71 Including NAS-CPM for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION).

C. In accordance with FAR 52.236 – 1 (PERFORMANCE OF WORK BY THE CONTRACTOR), the Contractor shall submit, simultaneously with the cost per work activity/event of the construction schedule required by this Section, a responsibility code for all activities/events of the project for which the Contractor's forces will perform the work.

D. The Contractor shall cost load work activities/events for all BID ITEMS including ASBESTOS ABATEMENT. The sum of each BID ITEM work shall equal the value of the bid item in the Contractors' bid.

1.7 PROJECT SCHEDULE REQUIREMENTS

A. Show on the project schedule the sequence of work activities/events required for complete performance of all items of work. The Contractor Shall:

1. Show activities/events as:

a. Contractor's time required for submittal of shop drawings, material lead times greater than seven days, templates, fabrication, delivery and similar pre-construction work.

b. Contracting Officer's and Architect-Engineer's review and approval of shop drawings, equipment schedules, samples, template, or similar items.

c. Interruption of VA Facilities utilities, delivery of Government furnished equipment, and rough-in drawings, project phasing and any other specification requirements.
d. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.
e. VA inspection and acceptance activity/event with a minimum duration of five work days at the end of each phase and immediately preceding any VA move activity/event required by the contract phasing for that phase.
f. Section 01 35 26 Safety Requirements section 1.5 Activity Hazard Analyses (AHA): For each phase of work, there shall be a task on the project schedule for AHA submittal and VA approval.
g. Cure time on products is critical to the project. The schedule shall show any cure times greater than seven calendar days.
h. Set up a minimum of two milestone dates for each month.

2. Show not only the activities/events for actual construction work for each trade category of the project, but also trade relationships to indicate the movement of trades from one area, floor, or building, to another area, floor, or building, for at least five trades who are performing major work under this contract.
3. Break up the work into activities/events of a duration no longer than 20 work days each or one reporting period, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the COTR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will not be less than 20 work days.
4. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion. Activities/events labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.
5. The schedule shall be generally numbered in such a way to reflect either discipline, phase or location of the work.

6. For each VA move-out, the contractor shall schedule 5 working days for the VA to remove any electronics, followed by 10 working days for the VA to remove VA-owned materials.
7. For each VA move-in, the contractor shall schedule 10 working days for the VA to move in, followed by 5 working days for the VA to install electronics.
8. After-hours work by the contractor is expected near entrances and 24-hour-a-day access points. The contractor may also work holidays if needed and coordinate all after-hours and holiday work with the COR 30 days ahead of the affected task. Show all after-hours and holiday work within the schedule as a separate filterable search and font or line color change to indicate the after-hours status.

B. The Contractor shall submit the following supporting data in addition to the project schedule:
   1. The appropriate project calendar, including working days and holidays.
   2. The planned number of shifts per day.
   3. The number of hours per shift.

   Failure of the Contractor to include this data shall delay the review of the submittal until the Contracting Officer is in receipt of the missing data.

C. To the extent that the Project Schedule or any revised Project Schedule shows anything not jointly agreed upon, it shall not be deemed to have been approved by the COTR. Failure to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date of each phase regardless of the COTR’s approval of the Project Schedule.

D. Compact Disk Requirements and CPM Activity/Event Record Specifications: Submit to the VA an electronic file(s) and upload to the cloud-based software containing one file of the data required to produce a schedule, reflecting all the activities/events of the complete project schedule being submitted.

1.8 PAYMENT TO THE CONTRACTOR:

A. Monthly, the contractor shall submit an application and certificate for payment using VA Form 10-6001a or the AIA application and certificate

for payment documents G702 & G703 reflecting updated schedule activities and cost data in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, FAR 52.232 – 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.232 – Article 71 Including NAS-CPMfor (PAYMENTS UNDER FIXED PRICE CONSTRUCTION). The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated project schedule. Monthly payment requests shall include: a listing of all agreed upon project schedule changes and associated data; and an electronic file (s) of the resulting monthly updated schedule.

B. Approval of the Contractor’s monthly Application for Payment shall be contingent, among other factors, on the submittal of a satisfactory monthly update of the project schedule.

1.9 PAYMENT AND PROGRESS REPORTING

A. Monthly schedule update meetings will be held on dates mutually agreed to by the COTR and the Contractor. Contractor and their CPM consultant (if applicable) shall attend all monthly schedule update meetings. The Contractor shall accurately update the Project Schedule and all other data required and provide this information to the COTR three work days in advance of the schedule update meeting. Job progress will be reviewed to verify:

1. Actual start and/or finish dates for updated/completed activities/events.
2. Remaining duration for each activity/event started, or scheduled to start, but not completed.
3. Logic, time and cost data for change orders, and supplemental agreements that are to be incorporated into the Project Schedule.
4. Changes in activity/event sequence and/or duration which have been made, pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.
5. Completion percentage for all completed and partially completed activities/events.
6. Logic and duration revisions required by this section of the specifications.

7. Activity/event duration and percent complete shall be updated independently.

B. After completion of the joint review, the contractor shall generate an updated computer-produced calendar-dated schedule and supply the Contracting Officer’s representative with reports in accordance with the Article, COMPUTER PRODUCED SCHEDULES, specified.

C. After completing the monthly schedule update, the contractor’s representative or scheduling consultant shall rerun all current period contract change(s) against the prior approved monthly project schedule. The analysis shall only include original workday durations and schedule logic agreed upon by the contractor and COR for the contract change(s). When there is a disagreement on logic and/or durations, the Contractor shall use the schedule logic and/or durations provided and approved by the COR. After each rerun update, the resulting electronic project schedule data file shall be appropriately identified and submitted to the VA in accordance to the requirements listed in articles 1.4 and 1.7. This electronic submission is separate from the regular monthly project schedule update requirements and shall be submitted to the COR within fourteen (14) calendar days of completing the regular schedule update. Before inserting the contract changes durations, care must be taken to ensure that only the original durations will be used for the analysis, not the reported durations after progress. In addition, once the final network diagram is approved, the contractor must recreate all manual progress payment updates on this approved network diagram and associated reruns for contract changes in each of these update periods as outlined above for regular update periods. This will require detailed record keeping for each of the manual progress payment updates.

D. Following approval of the CPM schedule, the VA, the General Contractor, its approved CPM Consultant, RE office representatives, and all subcontractors needed, as determined by the SRE, shall meet to discuss the monthly updated schedule. The main emphasis shall be to address work activities to avoid slippage of project schedule and to identify any necessary actions required to maintain project schedule during the reporting period. The Government representatives and the Contractor should conclude the meeting with a clear understanding of those work and administrative actions necessary to maintain project schedule

status during the reporting period. This schedule coordination meeting will occur after each monthly project schedule update meeting utilizing the resulting schedule reports from that schedule update. If the project is behind schedule, discussions should include ways to prevent further slippage as well as ways to improve the project schedule status, when appropriate.

E. The “Monthly Updated Schedule Progress Meeting” shall be a task on the project schedule each month.

1.10 RESPONSIBILITY FOR COMPLETION

A. If it becomes apparent from the current revised monthly progress schedule that phasing or contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:
   1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
   2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
   3. Reschedule the work in conformance with the specification requirements.

B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the COTR for the proposed schedule changes. If such actions are approved, the representative schedule revisions shall be incorporated by the Contractor into the Project Schedule before the next update, at no additional cost to the Government.

1.11 CHANGES TO THE SCHEDULE

A. Within 30 calendar days after VA acceptance and approval of any updated project schedule, the Contractor shall submit a revised electronic file (s) and a list of any activity/event changes including predecessors and successors for any of the following reasons:
   1. Delay in completion of any activity/event or group of activities/events, which may be involved with contract changes, strikes, unusual weather, that is not conducive to material installation, The project schedule shall indicate the allotted weather delays for each phase of work and these days must be exhausted before requesting additional weather delays, and other

delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as the direct cause for delaying the project beyond the acceptable limits.

2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
3. The schedule does not represent the actual prosecution and progress of the project.
4. When there is, or has been, a substantial revision to the activity/event costs regardless of the cause for these revisions.

B. CPM revisions made under this paragraph which affect the previously approved computer-produced schedules for Government furnished equipment, vacating of areas by the VA Facility, contract phase(s) and sub phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, shall be furnished in writing to the Contracting Officer for approval.

C. Contracting Officer's approval for the revised project schedule and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements by the Contracting Officer or the VA representative.

D. The cost of revisions to the project schedule resulting from contract changes will be included in the proposal for changes in work as specified in FAR 52.243 – 4 (Changes, and will be based on the complexity of the revision or contract change, man hours expended in analyzing the change, and the total cost of the change.

E. The cost of revisions to the Project Schedule not resulting from contract changes is the responsibility of the Contractor.

1.12 ADJUSTMENT OF CONTRACT COMPLETION

A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the COTR may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on revised activity/event logic, durations (in work days) and costs is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in this request. The Contracting

Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.

B. Actual delays in activities/events which, according to the computer- produced calendar-dated schedule, do not affect the extended and predicted contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date. The Contracting Officer will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the Contracting Officer's decision.

C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under FAR 52.243 – 4 (Changes). The Contractor shall include, as a part of each change order proposal, a sketch showing all CPM logic revisions, duration (in work days) changes, and cost changes, for work in question and its relationship to other activities on the approved network diagram.

D. All delays due to non-work activities/events such as RFI’s, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis.

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SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 – GENERAL

1.1 DESCRIPTION

A. This specification defines the general requirements and procedures for submittals. A submittal is information submitted for VA review to establish compliance with the contract documents.

B. Detailed submittal requirements are found in the technical sections of the contract specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective technical specifications at no additional cost to the government.

C. VA approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor’s expense.

1.2 DEFINITIONS

A. Preconstruction Submittals: Submittals which are required prior to issuing contract notice to proceed or starting construction. For example, Certificates of insurance; Surety bonds; Site-specific safety plan; Construction progress schedule; Schedule of values; Submittal register; List of proposed subcontractors.

B. Shop Drawings: Drawings, diagrams, and schedules specifically prepared to illustrate some portion of the work. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be integrated and coordinated.

C. Product Data: Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions, and brochures, which describe and illustrate size, physical appearance, and other characteristics of materials, systems, or equipment for some portion of the work. Samples of warranty language when the contract requires extended product warranties.

D. Samples: Physical examples of materials, equipment, or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged. Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project. Field samples and mock-ups constructed to establish standards by which the ensuing work can be judged.

E. Design Data: Calculations, mix designs, analyses, or other data pertaining to a part of work.

F. Test Reports: Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work. Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

G. Certificates: Document required of Contractor, or of a manufacturer, supplier, installer, or subcontractor through Contractor. The purpose is to document procedures, acceptability of methods, or personnel qualifications for a portion of the work.

H. Manufacturer's Instructions: Pre-printed material describing installation of a product, system, or material, including special notices and MSDS concerning impedances, hazards, and safety precautions.

I. Manufacturer's Field Reports: Documentation of the testing and verification actions taken by manufacturer's representative at the job site on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must indicate whether the material, product, or system has passed or failed the test.

J. Operation and Maintenance Data: Manufacturer data that is required to operate, maintain, troubleshoot, and repair equipment, including manufacturer's help, parts list, and product line documentation. This data shall be incorporated in an operations and maintenance manual.

K. Closeout Submittals: Documentation necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a phase of construction on a multi-phase contract.

1.3 SUBMITTAL REGISTER

A. The submittal register will list items of equipment and materials for which he contract documents but which have been omitted from the submittal register.

B. The submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period.

C. The VA will provide a blank submittal register in electronic format. Thereafter, the Contractor shall fill in the blank register with the required submittals as documented in the project spec. The Contractor shall track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the VA.

D. Blank digital register provided for Contractor use below

ENG_FORM_4288-R.pdf

D. The Contractor shall update the submittal register as submittal actions occur and maintain the submittal register at the project site until final acceptance of all work by Contracting Officer.

E. The Contractor shall submit formal monthly updates to the submittal register in electronic format. Each monthly update shall document actual submission and approval dates for each submittal.

1.4 SUBMITTAL SCHEDULING

A. Submittals are to be scheduled, submitted, reviewed, and approved prior to the acquisition of the material or equipment.

B. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow time for potential resubmittal.

C. No delay costs or time extensions will be allowed for time lost in late submittals or resubmittals.

D. All submittals are required to be approved prior to the start of the specified work activity.

1.5 SUBMITTAL PREPARATION

A. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

B. Collect required data for each specific material, product, unit of work, or system into a single submittal. Prominently mark choices, options, and portions applicable to the submittal. Partial submittals will not be accepted for expedition of construction effort. Submittal will be returned without review if incomplete.

C. If available product data is incomplete, provide Contractor-prepared documentation to supplement product data and satisfy submittal requirements.

D. All irrelevant or unnecessary data shall be removed from the submittal to facilitate accuracy and timely processing. Submittals that contain the excessive amount of irrelevant or unnecessary data will be returned without review.

E. Provide a transmittal form for each submittal with the following information:

1. Project title, location and number.
2. Construction contract number.
3. Date of the drawings and revisions.
4. Name, address, and telephone number of subcontractor, supplier, manufacturer, and any other subcontractor associated with the submittal.
5. List paragraph number of the specification section and sheet number of the contract drawings by which the submittal is required.
6. When a resubmission, add alphabetic suffix on submittal description. For example, submittal 18 would become 18A, to indicate resubmission.
7. Product identification and location in project.

F. The Contractor is responsible for reviewing and certifying that all submittals are in compliance with contract requirements before submitting for VA review. Proposed deviations from the contract requirements are to be clearly identified. All deviations submitted must include a side by side comparison of item being proposed against item specified. Failure to point out deviations will result in the VA requiring removal and replacement of such work at the Contractor's expense.

G. Stamp, sign, and date each submittal transmittal form indicating action taken.

H. Stamp used by the Contractor on the submittal transmittal form to certify that the submittal meets contract requirements is to be similar to the following:

CONTRACTOR
(Firm Name)
_____Approved
_____Approved with corrections as noted on submittal data and/or attached sheets(s)
SIGNATURE: _____
TITLE: _____
DATE: _____

1.6 SUBMITTAL FORMAT AND TRANSMISSION

A. Provide submittals in electronic format, with the exception of material samples. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer.

B. Compile the electronic submittal file as a single, complete document. Name the electronic submittal file specifically according to its contents.

C. Electronic files must be of sufficient quality that all information is legible. Generate PDF files from original documents so that the text included in the PDF file is both searchable and can be copied. If documents are scanned, Optical Character Resolution (OCR) routines are required.

D. E-mail electronic submittal documents smaller than 5MB in size to e-mail addresses as directed by the Contracting Officer.

E. Provide electronic documents over 5MB through an electronic FTP file sharing system. Confirm that the electronic FTP file sharing system can be accessed from the VA computer network. The Contractor is responsible for setting up, providing, and maintaining the electronic FTP file sharing system for the construction contract period of performance.

F. Provide hard copies of submittals when requested by the Contracting Officer. Up to 3 additional hard copies of any submittal may be requested at the discretion of the Contracting Officer, at no additional cost to the VA.

1.7 SAMPLES

A. Submit two sets of physical samples showing range of variation, for each required item.

B. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified.

C. When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

D. Before submitting samples, the Contractor is to ensure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

E. The VA reserves the right to disapprove any material or equipment which previously has proven unsatisfactory in service.

F. Physical samples supplied maybe requested back for use in the project after reviewed and approved.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

B. In the event the Contractor fails to deliver O&M Data within the time limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such O&M Data are applicable.

1.9 TEST REPORTS

COR may require specific test after work has been installed or completed which could require contractor to repair test area at no additional cost to contract.

1.10 VA REVIEW OF SUBMITTALS AND RFIS

A. The VA will review all submittals for compliance with the technical requirements of the contract documents. The Architect-Engineer for this project will assist the VA in reviewing all submittals and determining contractual compliance. Review will be only for conformance with the applicable codes, standards and contract requirements.

B. Period of review for submittals begins when the VA COR receives submittal from the Contractor.

C. Period of review for each resubmittal is the same as for initial submittal.

D. VA review period is 15 business days for submittals.

E. VA review period is 10 business days for RFIs.

F. The VA will return submittals to the Contractor with the following notations:

1. "Approved": authorizes the Contractor to proceed with the work covered.
2. "Approved as noted": authorizes the Contractor to proceed with the work covered provided the Contractor incorporates the noted comments and makes the noted corrections.
3. "Disapproved, revise and resubmit": indicates noncompliance with the contract requirements or that submittal is incomplete. Resubmit with appropriate changes and corrections. No work shall proceed for this item until resubmittal is approved.
4. "Not reviewed": indicates submittal does not have evidence of being reviewed and approved by Contractor or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals after taking appropriate action.

1.11 APPROVED SUBMITTALS

A. The VA approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.

B. VA approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor’s expense.

C. After submittals have been approved, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

D. Retain a copy of all approved submittals at project site, including approved samples.

1.12 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

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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 Professionals (ASSP):

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

Z359.0-2012.....Definitions and Nomenclature Used for Fall Protection and Fall Arrest

Z359.1-2016.....The Fall Protection Code

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):

10-2018.....Standard for Portable Fire Extinguishers

30-2018.....Flammable and Combustible Liquids Code

51B-2019.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work

70-2020.....National Electrical Code

70B-2019.....Recommended Practice for Electrical Equipment Maintenance

70E-2018 .....Standard for Electrical Safety in the Workplace

241-2019.....Standard for Safeguarding Construction, Alteration, and Demolition Operations

703-2024.....Standard for Fire Retardant–Treated Wood and Fire-Retardant Coatings for Building Materials

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. US Army Corps of Engineers Safety and Occupational Health (SOH) Requirements Publication No. EM 385-1-1, 2024 edition

1.2 DEFINITIONS:

A. Critical Lift. A lift with the hoisted load exceeding 75% of the crane’s maximum capacity; lifts made out of the view of the operator (blind picks); lifts involving two or more cranes; personnel being hoisted; and special hazards such as lifts over occupied facilities, loads lifted close to power-lines, and lifts in high winds or where

other adverse environmental conditions exist; and any lift which the crane operator believes is critical.

B. 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)).

C. Competent Person, Confined Space
The CP, Confined Space, is a person meeting the competent person requirements as defined EM 385-1-1 Appendix Q, with thorough knowledge of OSHA’s Confined Space Standard, 29 CFR 1910.146, and designated in writing to be responsible for the immediate supervision, implementation and monitoring of the confined space program, who through training, knowledge and experience in confined space entry is capable of identifying, evaluating and addressing existing and potential confined space hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

D. Competent Person, Cranes and Rigging.
The CP, Cranes and Rigging, as defined in EM 385-1-1 Appendix Q, is a person meeting the competent person, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the Crane and Rigging Program, who through training, knowledge and experience in crane and rigging is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures regarding such hazards.

E. Competent Person, Excavation/Trenching.
A CP, Excavation/Trenching, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and 29 CFR 1926, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the excavation/trenching program, who through training, knowledge and experience in excavation/trenching is capable of identifying,

evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

F. Competent Person, Fall Protection
The CP, Fall Protection, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and in accordance with ASSE/SAFE Z359.0, who has been designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the fall protection program, who through training, knowledge and experience in fall protection and rescue systems and equipment, is capable of identifying, evaluating and addressing existing and potential fall hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

G. Competent Person, Scaffolding
The CP, Scaffolding is a person meeting the competent person requirements in EM 385-1-1 Appendix Q and designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the scaffolding program. The CP for Scaffolding has enough training, knowledge and experience in scaffolding to correctly identify, evaluate and address existing and potential hazards and has the authority to take prompt corrective measures with regard to these hazards. CP qualifications must be documented and include experience on the specific scaffolding systems/types being used, assessment of the base material that the scaffold will be erected upon, load calculations for materials and personnel, and erection and dismantling. The CP for scaffolding must have a documented, minimum of 8-hours of scaffold training to include training on the specific type of scaffold being used (e.g. mast-climbing, adjustable, tubular frame), in accordance with EM 385-1-1 Section 22.B.02.

H. Competent Person (CP) Trainer
A competent person trainer as defined in EM 385-1-1 Appendix Q, who is qualified in the material presented, and who possesses a working knowledge of applicable technical regulations, standards, equipment and systems related to the subject matter on which they are training

Competent Persons. A competent person trainer must be familiar with the typical hazards and the equipment used in the industry they are instructing. The training provided by the competent person trainer must be appropriate to that specific industry. The competent person trainer must evaluate the knowledge and skills of the competent persons as part of the training process.

I. High Risk Activities
High Risk Activities are activities that involve work at heights, crane and rigging, excavations and trenching, scaffolding, electrical work, and confined space entry.

J. "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.

K. Qualified Person, Fall Protection (QP for FP)
A QP for FP is a person meeting the requirements of EM 385-1-1 Appendix Q, and ASSE/SAFE Z359.0, with a recognized degree or professional certificate and with extensive knowledge, training and experience in the fall protection and rescue field who is capable of designing, analyzing, and evaluating and specifying fall protection and rescue systems.

L. USACE Property and Equipment
Interpret "USACE" property and equipment specified in USACE EM 385-1-1 as Government property and equipment.

M. High Visibility Accident. Any mishap which may generate publicity or high visibility.

N. Mishap: Mishap in this specification is defined according to the EM 385-1-1. A mishap is any unplanned, undesired event that occurs during the course of work being performed. This includes accidents, incidents, and near misses.

O. Mishap Criticality Categories

1. No impact/Near-Miss – near miss incidents that shall be investigated and reported to the VA within 24 hours.

2. Minor incident/impact – incidents that require first aid or result in minor equipment damage (less than $5000). These incidents must be investigated and reported to the VA within 24 hours.

3. Moderate incident/impact – Any work-related injury or illness that results in any of the following. These incidents must be investigated and are required to be reported to the VA within 2 hours.

   a. Days away from work (any time lost after day of injury/illness onset);

   b. Restricted work;

   c. Transfer to another job;

   d. Medical treatment beyond first aid;

   e. Loss of consciousness;

   f. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (5) above or,

   g. any incident that leads to major equipment damage (greater than $5000).

4. Major incident/impact – Any mishap that leads to fatalities, hospitalizations, amputations, and losses of an eye as a result of contractors’ activities. Or any incident which leads to major property damage (greater than $20,000) and/or may generate publicity or high visibility. These incidents must be investigated and are required to be reported to the VA as soon as practical, but not later than 2 hours after the incident.

P. Load Handling Equipment (LHE)
LHE is a term used to describe cranes, hoists and all other hoisting equipment (hoisting equipment means equipment, including crane, derricks, hoists and power operated equipment used with rigging to raise, lower or horizontally move a load).

Q. 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 physician or registered personnel.

1.3 SUBMITTAL REQUIREMENTS:

A. Government approval or concurrence is required for submittals with a "G" designation; submittals not having a "G" designation are submitted for information only.

B. Preconstruction Submittals

1. Accident Prevention Plan (APP); G

C. Reports

1. Monthly Contractor Health Safety and Environmental (HS&E) Performance Report; G

2. Notifications and Reports;

3. Mishap Reports;

4. Near-Miss Reports;

5. LHE Inspection Reports

6. Monthly Exposure Hour Reports;

D. Work Plans

1. Standard Lift Plan; G

2. Critical Lift Plan; G

3. Activity Hazard Analysis (AHA); G

4. Confined Space Entry Permit

5. Hot Work Permit

6. Radiography Operation Planning Work Sheet; G

7. Portable Gauge Operations Planning Worksheet; G

E. Certificates

1. Contractor Safety Self-Evaluation Checklist

2. Crane Operators/Riggers Certifications; G

3. Certificate of Compliance

4. Mobile Cranes Inspection Certificate

5. License Certificates

6. Machinery & Mechanized Equipment Certification Form

1.4 REGULATORY REQUIREMENTS:

A. In addition to the detailed requirements included in the provisions of this contract, comply with the most recent edition of USACE EM 385-1-1, comply with 29 CFR 1926, comply with 29 CFR 1910 as incorporated by reference within 29 CFR 1926, comply with ASSP 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 Contracting Officer Representative or Government Designated Authority.

1.5 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 Mishap 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. Specifically articulating the safety requirements found within these VA contract safety specifications and the latest version of the United States Army Corps of Engineers – Safety and Occupational Health (SOH) Requirements - EM 385-1-1 Manual. Model language and format can be found in Appendix A of the EM 385-1-1 Manual

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. The Statement of Safety and Health Policy must be signed by a company executive.

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 or EM 385-1-1 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 Construction Outreach training within the past five years is required for all workers on site and the OSHA 30-hour Construction Outreach training within the past five years 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. **MISHAP INVESTIGATION & REPORTING.**

1) The APP shall include identify person(s) responsible to provide the following to the Contracting Officer Representative Government Designated Authority :

1. Monthly HS&E Performance Report (Exposure Hours Data);
2. Mishap investigation reports;
3. Project site injury and illness logs;
4. Near-Miss reports;

i. **PLANS (PROGRAMS, PROCEDURES) REQUIRED.** Based on a risk assessment of contracted activities and on mandatory OSHA and/or EM 385-1-1 compliance programs, the Contractor shall address all applicable occupational, patient, and public safety risks in site-specific compliance and accident prevention plans. These Plans shall include but are not limited to procedures for addressing the risks associated 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 (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) Pre-Cast Concrete;

28) Public (Mandatory compliance with ANSI/ASSP A10.34-2012);

29) Sub-contractor or cross-trade coordination;

C. Submit the APP to the Contracting Officer Representative 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 safety conference for acceptance. Work cannot proceed without an accepted APP.

D. Once accepted by the Contracting Officer Representative, 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 in accordance with FAR Clause 52.236-13, *Accident Prevention*, 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 Resident Engineer, Contracting Officer Representative or Government Designated Authority. 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 Resident Engineering Office and Contracting Officer within 2 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions to safeguard onsite personnel, visitors, the public and the environment.

1.6 ACTIVITY HAZARD ANALYSES (AHAS): (AHAS SHALL BE A TASK ON THE PROJECT SCHEDULE FOR EACH PHASE OF WORK)

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 Contracting Officer Representative or Government Designated Authority 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, EM 385-1-1, 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 Contracting Officer Representative Government Designated Authority 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 weekly) 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 Contracting Officer Representative or Government Designated Authority for review for compliance.

1.7 PRECONSTRUCTION SAFETY 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 pre-construction safety 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.

1.8 SAFETY MEETINGS:

Conduct safety meetings to review past activities, plan for new or changed operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent Safety and Occupational Health (SOH) training and motivation. Conduct meetings at least once a month for all supervisors on the project location. The SSHO, supervisors, foremen, or CDSOs must conduct meetings at least once a week for the trade workers. Document meeting minutes to include the date, persons in attendance, subjects discussed, and names of individual(s) who conducted the meeting. Maintain documentation on-site and furnish copies to the Contracting

Officer on request. Notify the Contracting Officer of all scheduled meetings 7 calendar days in advance.

1.9 “SITE SAFETY AND HEALTH OFFICER” (SSHO) AND “COMPETENT PERSON” (CP):

A. The Prime Contractor shall provide a Safety oversight team that includes a minimum of one (1) person at each project site to function as the Site Safety and Health Officer (SSHO). The Prime Contractor shall provide a minimum of one “Part-Time 4 hour on-site per work week” SSHO at each project site, for each shift (with no other duties) that holds as current, a professional safety certification with at least 3 years of dedicated construction safety related experience. The SSHO shall ensure that the requirements of the VA and of 29 CFR 1926.16 are met for the project. The SSHO must be at the work site each week during construction activities to implement and administer the Contractor's safety program and government-accepted Accident Prevention Plan..

B. 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). However, the SSHO has be a separate qualified individual from the Prime Contractor’s Superintendent and/or Quality Control Manager with duties only as the SSHO

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).

1.10 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.

B. As a minimum the SSHO must have completed the OSHA 30-hour Construction Safety Outreach class within the past five (5) years and:

1. Seven (7) years of construction industry safety related experience.

2. OR have a safety and health degree from an accredited university or college and five (5) years of construction industry safety related experience

3. OR hold as current, a Certified Safety Professional (CSP) or a Construction Health and Safety Technician (CHST) certification and five (3) years of construction industry safety related experience.

C. The Alternate Safety Officer shall meet, at a minimum, the requirements of EM 385-1-1 Section 1 and have five (5) years of construction industry safety experience If the SSHO does not have a current certification, certification must be obtained within 90 days, maximum, of contract award.

D. All designated CPs shall have completed the OSHA 30-hour Construction Safety course and/or EM 385-1-1 40-hour training within the past 5 years. In addition, 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 and control associated with those high hazard work operations. Documented “repeat” deficiencies in the execution of safety requirements will require retaking the requisite formal course.

E. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course within the past 5 years and any necessary safety training to be able to identify hazards within their work environment.

F. Submit training records associated with the above training requirements to Contracting Officer Representative 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 safety conference for acceptance.

G. 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.

H. Ongoing safety training will be accomplished in the form of weekly documented safety meeting.

1.11 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 their work operations as required by 29 CFR 1926.20(b)(2). Each week, the SSHO shall conduct a formal documented inspection with a written report 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 Contracting Officer Representative.

B. A Certified Safety Professional (CSP) with specialized knowledge in construction safety or a certified Construction Safety and Health Technician (CSHT) shall randomly conduct a monthly site safety inspection. The CSP or CSHT shall be one that is not a part of the immediate site project team. The individual can be a corporate safety professional or independently contracted who is not an immediate member of the construction project site team. The CSP or CSHT will provide their certificate number on the required report for verification as necessary.

1. Results of the inspection will be documented with tracking of the identified hazards to abatement.

2. The Contracting Officer Representative will be notified immediately prior to start of the inspection and invited to accompany the inspection.

3. Identified hazard and controls will be discussed to come to a mutual understanding to ensure abatement and prevent future reoccurrence.

4. A report of the inspection findings with status of abatement will be provided to the Contracting Officer Representative within one week of the onsite inspection.

1.12 MISHAPS, OSHA 300 LOGS, AND EXPOSURE-HOURS:

A. The prime contractor shall establish and maintain a Near-Miss and Mishap reporting, recordkeeping, and analysis system to track and analyze all injuries and illnesses, high visibility incidents, and accidental property damage (both government and contractor) that occur on site. Notify and provide an initial report to the Contracting Officer Representative as soon as practical, but no more than two hours after any Moderate or Major Mishap, High Visibility Incidents, or any weight handling and hoisting equipment mishap. No Impact/Near-Miss and Minor Mishaps shall be reported within 24 hours or as soon as practical. Within the notification the sender shall include contractor name; contract title; type of contract; name of activity, installation or location where mishap 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 mishap (to include type of

construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the Mishap site until the Contracting Officer Representative determines whether a government investigation will be conducted.

B. Conduct a mishap investigation for all Mishaps including mishaps resulting in at least $20,000 in damages without injury, to establish the root cause(s) of the mishap. The Mishap investigation shall include images, 5 whys, the injured person’s firsthand account, any witness accounts, methods of procedures, related AHA to the task, and corrective action plan signed by the president, vice president, or appropriate corporate-level leadership identified in the company’s org chart for the project. Additionally, complete the VA Form 2162 (or equivalent) and provide the report to the Contracting Officer Representative within 7 calendar days of the accident. The Contracting Officer Representative will provide copies of any required or special forms.

C. A summation of all exposure-hours worked by the contractor and associated sub-contractors for each month will be reported to Contracting Officer Representative no later than the 10th day of the following month.

D. A summation of all Minor, Moderate, and Major incidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Contracting Officer Representative monthly. The contractor and associated sub-contractors’ OSHA 300 logs will be made available to the Contracting Officer Representative upon request.

1.13 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. Any PPE above and beyond the Mandatory PPE identified below and determined by the Contracting Officer or their Representative to be necessary in the performance of the Governments duties relative to this contract, shall be provided to the Government upon written notification

by the Contracting Officer and at no additional expense to the Government. All PPE provided to the Government shall also be accompanied by any relevant or required training necessary to ensure its proper use.

C. Mandatory Minimum PPE includes:

1. Hard Hats – unless written authorization is given by the Contracting Officer Representative 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 and/or EM 385-1-1 regulations.

2. Safety glasses - unless written authorization is given by the Contracting Officer Representative in circumstances of no eye hazards, 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 Contracting Officer Representative in circumstances of no foot hazards.

4. Hearing protection - Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.

5. High-visibility Safety Apparel – appropriate brightly colored clothing that feature some type of reflective material on them, such as safety vests, shall be worn by personnel or visitors on construction sites.

1.14 PRE-CONSTRUCTION RISK ASSESSMENT

A. Control of all construction-associated hazards that affect VA medical facilities, their occupants, services and mission-essential functions and capabilities is critical in all medical center facilities. VHA Pre-Construction Risk Assessments (PCRAs) for construction, renovation

and maintenance projects are included with this contract solicitation with required mitigations of identified hazards. VHA-PCRAs will be re-validated and updated as needed based on but not limited to changes from original designs, affected individuals, areas/locations, scope, contractor means and methods, safety requirements, phasing, contractor competencies and capabilities.

B. Infection Prevention and 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. A detailed analysis of potential risks for infectious disease transmission affecting the care, treatment or services of patients or residents has been conducted. VHA Infection Control Risk Assessments (ICRAs) are included with this contract solicitation with required mitigation actions/activities. VHA-ICRAs will be re-validated and updated as needed based on changes in original designs, affected individuals, area(s) or location(s), scope, contractor means and methods, infection prevention and control requirements, differing site conditions, phasing, contractor competencies and capabilities, and infectious disease outbreaks.

C. For work occurring at a VA medical facility, coordinate with the facility Safety Manager/Officer, as several aspects of this section directly relate to infection control risk assessments required in or adjacent to construction affecting occupied buildings accredited by The Joint Commission.

D. Products and Materials:

1. Sheet Plastic: Fire retardant polyethylene, 6-mil thickness meeting local fire codes or approved wall system.

2. Barrier Doors: Self Closing fire-rated solid core wood in steel frame, painted or approved wall system.

3. Dust proof fire-rated drywall or approved wall system.

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: EPA-registered, Hospital-approved disinfectant or equivalent product

8. Portable Ceiling Access Module

1.15 DUST CONTROL

A. Contractor shall verify that dust will not be introduced into the facility through intake vents or building openings. HEPA filtration on intake vents is required where dust may be introduced.

B. Dust created from disturbance of soil such as from vehicle movement will be wetted with use of a water truck as necessary.

C. All cutting, drilling, grinding, sanding, or disturbance of materials shall be accomplished with tools equipped with either local exhaust ventilation (i.e. vacuum systems) or wet suppression controls.

1.16 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.

1.17 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 Contracting Officer Representative 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. For work occurring at a VA medical facility, coordinate with the facility Safety Manager/Officer, as several aspects of this section directly relate to interim life safety measures required in or adjacent to construction affecting occupied buildings accredited by The Joint Commission.

D. 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).

E. Temporary Construction Partitions:

1. Install and maintain temporary construction partitions to provide smoke-tight separations between the areas that are described in phasing requirements and adjoining areas. Construct partitions of gypsum board, approved manufactured wall system, or fire-retardant treated plywood (fire-retardant treated in accordance with NFPA 703) on both sides of fire-retardant treated wood framing or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof or as noted on the drawings. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.

2. Install fire-rated 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.

F. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.

G. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Contracting Officer Representative.

H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Contracting Officer Representative.

I. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.

J. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.

L. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.

M. 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 Contracting Officer Representative. 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 Resident Engineer.

N. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Contracting Officer Representative.

O. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Facility Safety Office. Obtain permits from facility Safety Manager at least _48___ hours in advance . Designate contractor's responsible project-site fire prevention program manager to permit hot work.

P. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative.

Q. Smoking: Smoking is prohibited on VA property.

R. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.

S. 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.

1.18 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 when 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 Contracting Officer Representativewith approval of the Medical Center Director will make the determination if the circumstances would meet the exception outlined above. An AHA and permit specific to energized work activities will be developed, reviewed, and accepted by the VA prior to the start of that activity.

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 or Contracting Officer Representative.

D. 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 alterative and it is strongly suggested a full Arc Flash Hazard Analyses be conducted). Work shall not begin until the AHA for the work activity and permit for energized work has been reviewed and accepted by the Contracting Officer Representativeand discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

E. Ground-fault circuit interrupters. GFCI protection shall be provided where an employee is operating or using cord- and plug-connected tools related to construction activity supplied by 125-volt, 15-, 20-, or 30-ampere circuits. Where employees operate or use equipment supplied by greater than 125-volt, 15-, 20-, or 30- ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented in accordance with NFPA 70E - 2015, Chapter 1, Article 110.4(C)(2).

1.19 FALL PROTECTION

A. The fall protection (FP) threshold height requirement is 4ft for ALL WORK in government occupied sites, unless the OSHA 29 CFR 1926 or EM 385-1-1 requirements are more stringent, to include steel erection activities, systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work. For

work occurring at new “greenfield” sites or sites with 24/7 Contractor controlled 100% restricted access, the fall protection (FP) threshold height may be increased to 6ft unless the OSHA 29 CFR 1926 or EM 385-1-1 requirements are more stringent.

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 more stringent of OSHA and EM 385-1-1 requirements.

1.20 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 4 ft 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.

1.21 EXCAVATION AND TRENCHES

A. All excavation and trenching work shall comply with 29 CFR 1926 Subpart P. Excavations less than 5 feet in depth require evaluation by the contractor’s “Competent Person” (CP) for determination of the necessity of an excavation protective system where kneeing, laying in, or stooping within the excavation is required.

B. All excavations and trenches 24 inches in depth or greater shall require a written trenching and excavation permit (NOTE – some States and other local jurisdictions require separate state/jurisdiction-issued excavation permits). The permit shall have two sections, one section will be completed prior to digging or drilling and the other will be completed prior to personnel entering the excavations greater than 5 feet in depth. Each section of the permit shall be provided to the Facility Safety Manager,Officer and/or other Government Designated Authority prior to proceeding with digging or drilling and prior to proceeding with entering the excavation. After completion of the work and prior to opening a new section of an excavation, the permit shall be closed out and provided to the Facility Safety Manager, Officer and/or other Government Designated Authority. The permit shall be maintained onsite, and the first section of the permit shall include the following:

1. Estimated start time & stop time

2. Specific location and nature of the work.

3. Indication of the contractor's "Competent Person" (CP) in excavation safety with qualifications and signature. Formal course in excavation safety is required by the contractor's CP.

4. Indication of whether soil or concrete removal to an offsite location is necessary.

5. Indication of whether soil samples are required to determined soil contamination.

6. Indication of coordination with local authority (i.e. "One Call") or contractor's effort to determine utility location with search and survey equipment.

7. Indication of review of site drawings for proximity of utilities to digging/drilling.

C. The second section of the permit for excavations greater than five feet in depth shall include the following:

1. Determination of OSHA classification of soil. Soil samples will be from freshly dug soil with samples taken from different soil type layers as necessary and placed at a safe distance from the excavation by the excavating equipment. A pocket penetrometer will be utilized in determination of the unconfined compression strength of the soil for comparison against OSHA table (Less than 0.5 Tons/FT2 – Type C, 0.5 Tons/FT2 to 1.5 Tons/FT2 – Type B, greater than 1.5 Tons/FT2 – Type A without condition to reduce to Type B).

2. Indication of selected protective system (sloping/benching, shoring, shielding). When soil classification is identified as "Type A" or "Solid Rock", only shoring or shielding or Professional Engineer designed systems can be used for protection. A Sloping/Benching system may only be used when classifying the soil as Type B or Type C. Refer to Appendix B of 29 CFR 1926, Subpart P for further information on protective systems designs.

3. Indication of the spoil pile being stored at least 2 feet from the edge of the excavation and safe access being provided within 25 feet of the workers.

4. Indication of assessment for a potential toxic, explosive, or oxygen deficient atmosphere where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist. Internal combustion engine equipment is not allowed in an excavation without providing force air ventilation to lower the concentration to below OSHA PELs, providing sufficient oxygen levels, and atmospheric testing as necessary to ensure safe levels are maintained.

C. As required by OSHA 29 CFR 1926.651(b)(1), the estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

1. The planned dig site will be outlined/marked in white prior to locating the utilities.

2. Used of the American Public Works Association Uniform Color Code is required for the marking of the proposed excavation and located utilities.

3. 811 will be called two business days before digging on all local or State lands and public Right-of Ways.

4. Digging will not commence until all known utilities are marked.

5. Utility markings will be maintained

D. Excavations will be hand dug or excavated by other similar safe and acceptable means as excavation operations approach within 3 to 5 feet of identified underground utilities. Exploratory bar or other detection equipment will be utilized as necessary to further identify the location of underground utilities.

E. Excavations greater than 20 feet in depth require a Professional Engineer designed excavation protective system.

1.22 CRANES

A. All crane work shall comply with 29 CFR 1926 Subpart CC and EM 385-1-1.

B. Prior to operating a crane, the operator must be licensed, qualified or certified to operate the crane. Thus, all the provisions contained with Subpart CC are effective and there is no “Phase In” date.

C. A detailed lift plan for all lifts shall be submitted to the Resident Engineer, COR and/or other Government Designated Authority 14 days prior to the scheduled lift complete with route for truck carrying load, crane load analysis, siting of crane and path of swing and all other elements of a critical lift plan where the lift meets the definition of a critical lift. Critical lifts require a more comprehensive lift plan to minimize the potential of crane failure and/or catastrophic loss. The plan must be reviewed and accepted by the General Contractor before being submitted to the VA for review. The lift will not be allowed to proceed without prior acceptance of this document by the Facility Safety Manager, Officer and/or other Government Designated Authority.

D. Crane operators shall not carry loads

1. over the general public or VAMC personnel

2. over any occupied building unless

a. The top two or more floors are vacated under the lift affected area AND a Contractor provided engineering analysis, performed by a Professional Engineer, demonstrates that overhead protection provided by the roof and vacated floors is sufficient to protect against the potential loss of a load being lifted or a minimum of 300 psf of protection is provided, whichever is greater

b. OR Overhead protection is designed by a Professional Engineer and installed over the roof by the Contractor to protect the occupants below. The installed system shall be sufficient to protect against the potential loss of a load being lifted or a minimum of 300 psf of protection is provided, whichever is greater.

c. OR A formal request may be submitted to the Contracting Officer for documentation, if available, indicating the roof of the building has been previously designed and constructed using a reinforced concrete roof slab or other means to provide overhead protection from construction activities specifically associated with the vertical or horizontal expansion of the same building AND a Contractor provided engineering analysis, performed by a Professional Engineer, demonstrates that overhead protection provided by the roof is sufficient to protect against the potential loss of a load being lifted or a minimum of 300 psf of protection is provided, whichever is greater.

1.23 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.

1.24 CONFINED SPACE ENTRY

A. All confined space entry shall comply with 29 CFR 1926, Subpart AA except for specifically referenced operations in 29 CFR 1926 such as excavations/trenches [1926.651(g)].

B. A site-specific Confined Space Entry Plan (including permitting process) shall be developed and submitted to the Facility Safety Manager, Officer and/or other Government Designated Authority.

1.25 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 Facility Safety Manager, Officer and/or other Government Designated Authority . Obtain permits from Facility Safety Manager, Officer and/or other Government Designated Authority at least __48__ hours in

advance . Designate contractor's responsible project-site fire prevention program manager to permit hot work.

1.26 LADDERS

A. All Ladder use shall comply with 29 CFR 1926 Subpart X and EM 385-1-1.

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.

1.27 FLOOR & WALL OPENINGS

A. All floor and wall openings shall comply with 29 CFR 1926 Subpart M and EM 385-1-1.

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. 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 toe boards 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:

DEPARMENT 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.
http://www.aluminum.org

AABC Associated Air Balance Council
https://www.aabc.com

AAMA American Architectural Manufacturer's Association
http://www.aamanet.org

AASHTO American Association of State Highway and Transportation Officials
http://www.aashto.org

AATCC American Association of Textile Chemists and Colorists
http://www.aatcc.org

ACGIH American Conference of Governmental Industrial Hygienists
http://www.acgih.org

ACI American Concrete Institute
http://www.aci-int.net

ACPA American Concrete Pipe Association
http://www.concrete-pipe.org

ACPPA American Concrete Pressure Pipe Association
http://www.acppa.org

ADC Air Diffusion Council
http://flexibleduct.org

AGA American Gas Association
http://www.aga.org

AGC Associated General Contractors of America
http://www.agc.org

AGMA American Gear Manufacturers Association, Inc.
http://www.agma.org

AH American Hort

https://www.americanhort.org

AHAM Association of Home Appliance Manufacturers
http://www.aham.org

AIA American Institute of Architects

http://www.aia.org

AISC American Institute of Steel Construction
http://www.aisc.org

AISI American Iron and Steel Institute
http://www.steel.org

AITC American Institute of Timber Construction
https://aitc-glulam.org

AMCA Air Movement and Control Association, Inc.
http://www.amca.org

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

ARPM Association for Rubber Product Manufacturers

https://arpm.com

ASABE American Society of Agricultural and Biological Engineers
https://www.asabe.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 International
http://www.asse-plumbing.org

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

AWI Architectural Woodwork Institute
https://www.awinet.org

AWS American Welding Society
https://www.aws.org

AWWA American Water Works Association
https://www.awwa.org

BHMA Builders Hardware Manufacturers Association
https://www.buildershardware.com

BIA The Brick Industry Association
http://www.gobrick.com

CAGI Compressed Air and Gas Institute
https://www.cagi.org

CGA Compressed Gas Association, Inc.
https://www.cganet.com

CI The Chlorine Institute, Inc.
https://www.chlorineinstitute.org

CISCA Ceilings and Interior Systems Construction Association
https://www.cisca.org

CISPI Cast Iron Soil Pipe Institute
https://www.cispi.org

CLFMI Chain Link Fence Manufacturers Institute
https://www.chainlinkinfo.org

CPA Composite Panel Association

https://www.compositepanel.org

CPMB Concrete Plant Manufacturers Bureau
https://www.cpmb.org

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

CRSI Concrete Reinforcing Steel Institute
https://www.crsi.org

CTI Cooling Technology Institute
https://www.cti.org

DHA Decorative Hardwoods Association

https://www.decorativehardwoods.org

DHI Door and Hardware Institute
https://www.dhi.org

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

EEI Edison Electric Institute
https://www.eei.org

EPA United States Environmental Protection Agency
https://www.epa.gov

ETL ETL Testing Services
http://www.intertek.com

FAA Federal Aviation Administration
https://www.faa.gov

FCC Federal Communications Commission
https://www.fcc.gov

FPS Forest Products Society
http://www.forestprod.org

GANA Glass Association of North America
http://www.glasswebsite.com

FM Factory Mutual Global Insurance
https://www.fmglobal.com

GA Gypsum Association
https://gypsum.org

GSA General Services Administration
https://www.gsa.gov

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

ICC International Code Council
https://shop.iccsafe.org

ICEA Insulated Cable Engineers Association
https://www.icea.net

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

IEEE Institute of Electrical and Electronics Engineers
https://www.ieee.org\

IGMA Insulating Glass Manufacturers Alliance

https://www.igmaonline.org

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

MBMA Metal Building Manufacturers Association
https://www.mbma.com

MSS Manufacturers Standardization Society of the Valve and Fittings Industry
http://msshq.org

NAAMM National Association of Architectural Metal Manufacturers
https://www.naamm.org

PHCC Plumbing-Heating-Cooling Contractors Association
https://www.phccweb.org

NBS National Bureau of Standards
See - NIST

NBBI The National Board of Boiler and Pressure Vessel Inspectors
https://www.nationalboard.org

NEC National Electric Code
See - NFPA National Fire Protection Association

NEMA National Electrical Manufacturers Association
https://www.nema.org

NFPA National Fire Protection Association
https://www.nfpa.org

NHLA National Hardwood Lumber Association
https://www.nhla.com

NIH National Institute of Health
https://www.nih.gov

NIST National Institute of Standards and Technology
https://www.nist.gov

NELMA Northeastern Lumber Manufacturers Association, Inc.
http://www.nelma.org

NPA National Particleboard Association
(See CPA, Composite Panel Association)

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

OSHA Occupational Safety and Health Administration
Department of Labor
https://www.osha.gov

PCA Portland Cement Association
https://www.cement.org

PCI Precast Prestressed Concrete Institute
https://www.pci.org

PPI Plastics Pipe Institute
https://www.plasticpipe.org

PEI Porcelain Enamel Institute
http://www.porcelainenamel.com

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

RFCI Resilient Floor Covering Institute
https://www.rfci.com

RIS Redwood Inspection Service
(See Western Wood Products Association)

https://www.wwpa.org

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

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

SJI Steel Joist Institute
https://www.steeljoist.org

SMACNA Sheet Metal & Air-Conditioning Contractors' National Association
https://www.smacna.org

SSPC The Society for Protective Coatings
https://www.sspc.org

STI Steel Tank Institute
https://www.steeltank.com

SWI Steel Window Institute
https://www.steelwindows.com

TCNA Tile Council of North America

https://www.tcnatile.com

TEMA Tubular Exchanger Manufacturers Association
http://www.tema.org

TPI Truss Plate Institute
https://www.tpinst.org

UBC The Uniform Building Code
(See ICC)

UL Underwriters' Laboratories Incorporated
https://www.ul.com

ULC Underwriters' Laboratories of Canada
https://www.ulc.ca

WCLB West Coast Lumber Inspection Bureau
http://www.wclib.org

WDMA Window and Door Manufacturers Association

https://www.wdma.com

WRCLA Western Red Cedar Lumber Association
https://www.realcedar.com

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

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SECTION 01 45 00
QUALITY CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies requirements for Contractor Quality Control (CQC) for Design-Bid-Build (DBB) or Design-Build (DB) construction projects. This section can be used for both project types.

1.2 APPLICABLE PUBLICATIONS

A. The publication listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

B. ASTM International (ASTM)

1. D3740 - (2012a) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
2. E329 - (2014a) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.3 SUBMITTALS

Government approval is required for all submittals. CQC inspection reports shall be submitted under this Specification section and follow the [Applicable CQC Control Phase (Preparatory, Initial, or Follow-Up)]: [Applicable Specification section] naming convention.

1. Preconstruction Submittals
   a. Interim CQC Plan
   b. CQC Plan
   c. Additional Requirements for Design Quality Control (DQC) Plan
2. Design Data
   a. Discipline-Specific Checklists
   b. Design Quality Control
3. Test Reports
   a. Verification Statement

PART 2 PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

Establish and maintain an effective quality control (QC) system. that complies with the FAR Clause 52.246.12 titled “Inspection of Construction”. QC consists of plans, procedures, and organization necessary to produce an end product which complies with the Contract requirements. The QC system covers all design and construction operations, both onsite and offsite, and be keyed to the proposed design and construction sequence. The project superintendent will be held responsible for the quality of work and is subject to removal by the Contracting Office or Authorized designee for non-compliance with the quality requirements specified in the Contract. In this context the highest level manager responsible for the overall construction activities at the site, including quality and production is the project superintendent. The project superintendent maintains a physical presence at the site at all times and is responsible for all construction and related activities at the site, except as otherwise acceptable to the Contracting Officer.

3.2 CQC PLAN:

A. Submit the CQC Plan no later than CO or Designee to determine during Constructability review –60 days after receipt of Notice to Proceed (NTP) proposed to implement the requirements of the FAR Clause 52.246.12 titled “Inspection of Construction”. The Government will consider an Interim CQC Plan to match timeline established which must be accepted within 20 business days of NTP. Design and/or construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an Interim plan applicable to the particular feature of work to be started. Work outside of the accepted Interim CQC Plan will not be permitted to begin until acceptance of a CQC Plan or another Interim CQC Plan containing the additional work scope is accepted.

B. Content of the CQC Plan: Include, as a minimum, the following to cover all design and construction operations, both onsite and offsite, including work by subcontractors, designers of record consultants, architects/engineers (A/E), fabricators, suppliers, and purchasing agents:

1. A description of the QC organization, including a chart showing lines of authority and acknowledgement that the CQC staff will implement the three phase control system for all aspects of the work specified. Include a CQC System Manager that reports to the project superintendent.
2. The name, qualifications (in resume format) duties, responsibilities, and authorities of each person assigned a CQC function.
3. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the Contract. Letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities will be issued by the CQC System Manager. Furnish copies of these letters to the Contracting Officer or Authorized designee.
4. Procedures for scheduling, reviewing, certifying, and managing submittals including those of subcontractors, designers of record, consultants, A/E’s offsite fabricators, suppliers and purchasing agents. These procedures must be in accordance with Section 01 33 23 Shop Drawings, Product Data, and Samples.
5. Control, verification, and acceptance of testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer or Authorized designee are required to be used)
6. Procedures for tracking Preparatory, Initial, and Follow-Up control phases and control, verification, and acceptance tests including documentation.
7. Procedures for tracking design and construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected.
8. Reporting procedures, including proposed reporting formats.

9. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks has separate control requirements, and is identified by different trades or disciplines, or it is work by the same trade in a different environment. Although each section of specifications can generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the Coordination meeting.
10. Coordinate schedule work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections and Schedule of Special Inspections. Where the applicable Code issue by the International Code Council (ICC) calls for inspections by the Building Official, the Contractor must include the inspections in the CQC Plan and must perform the inspections required by the applicable ICC. The Contractor must perform these inspections using independent qualified inspectors. Include the Special Inspection Plan requirements in the CQC Plan.

C. Additional Requirements for Design Quality Control (DQC) Plan: The following additional requirements apply to the DQC Plan for DB projects only and not DBB projects:
1. Submit and maintain a DQC Plan as an effective QC program which assures that all services required by this contract are performed and provided in a manner that meets professional architectural and engineering quality standards. As a minimum, all documents must be technically reviewed by competent, independent reviewers identified in the DQC Plan. The same element that produced the product may not perform the independent technical review (ITR). Correct errors and deficiencies in the design documents prior to submitting them to the Government.
2. Include the design schedule in the master project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific Contract period. This should be at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. Include review and correction periods associated with each item. This should be a forward planning as well as a project monitoring tool. The schedule reflects calendar days and not dates for each activity. If the

schedule is changed, submit a revised schedule reflecting the change within 7 calendar days. Include in the DQC Plan the discipline-specific checklists to be used during the design and quality control of each submittal. Submit at each design phase as part of the project documentation these completed discipline-specific checklists.

3. Implement the DQC Plan by a DQC Manager who has the responsibility of being cognizant of and assuring that all documents on the project have been coordinated. This individual must be a person who has verifiable engineering or architectural design experience and is a Professional Engineer or Registered Architect within the state of Construction location. Notify the Contracting Officer or Authorized designee, in writing, of the name of the individual, and the name of an alternate person assigned to the position.

D. Acceptance of Plan: Acceptance of the Contractor’s plan is required prior to the start of design and construction. Acceptance is conditional and will be predicated on satisfactory performance during the design and construction. The Government reserves the right to require the Contractor to make changes in the CQC Plan and operations including removal of personnel as necessary, to obtain the quality specified.

E. Notification of Changes: After acceptance of the CQC Plan, notify the Contracting Officer or Authorized designee in writing of any proposed change. Proposed changes are subject to acceptance by the Government prior to implementation by the Contractor.

3.3 COORDINATION MEETING:

After the Preconstruction Conference Post-award Conference before start of design or construction, and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer or Authorized designee to discuss the Contractor’s quality control system. Submit the CQC Plan a minimum of 5 business days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CC operations, design activities (if applicable), control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor’s Management and control with the Government’s Quality Assurance. Minutes of the meeting will be

prepared by the Government, signed by both the Contractor and Contracting Officer or Authorized designee and will become a part of the contract file. There can be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings or address deficiencies in the CQC system or procedures which can require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION:

A. Personnel Requirements: The requirements for the CQC organization are a Safety and Health Manager, CQC System Manager, a Design Quality Manager (if applicable), and sufficient number of additional qualified personnel to ensure safety and Contract compliance. The Safety and Health Manager shall satisfy the requirements of Specification 01 35 26 Safety Requirements and reports directly to a senior project (or corporate) official independent from the CQC System Manager. The Safety and Health Manager will also serve as a member of the CQC Staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor’s CQC staff maintains a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure Contract compliance. The CQC staff will be subject to acceptance by the Contracting Officer or Authorized designee. Provide adequate office space, filing systems, and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly complete and furnish all letters, material submittals, shop drawings submittals, schedules and all other project documentation to the CQC organization. The CQC organization is responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Government.

B. CQC System Manager: Identify as CQC System Manager an individual within the onsite work organization that is responsible for overall management of CQC and has the authority to act in all CQC matters for the Contractor. The CQC system Manager is required to be a graduate engineer, graduate architect, or a graduate of construction management, with PM or SRE to determine qualifications based on project complexity at construction review similar to the scope of this Contract. This CQC

System manager is on the site at all times during construction and is employed by the General Contractor. The CQC System Manger is assigned as CQC System Manager but has duties as project superintendent in addition to quality control. Identify in the plan an alternate to serve in the event of the CDQC System Manager’s absence. The requirements for the alternate are the same as the CQC System Manager.

C. CQC Personnel: In addition to CQC personnel specified elsewhere in the contract, provide as part of the CQC organization specialized personnel to assist in the CQC System Manager for the following areas, as applicable: electrical, mechanical, civil, structural, environmental, architectural, materials technician submittals clerk, Commissioning Agent/LEED specialist, and low voltage systems. These individuals or specified technical companies are directly employed by the General Contractor and cannot be employed by a supplier or subcontractor on this project; be responsible to the CQC System Manager; be physically present at the construction site during work on the specialized personnel’s areas of responsibility; have the necessary education or experience in accordance with the Experience Matrix listed herein. These individuals can perform other duties but need to be allowed sufficient time to perform the specialized personnel’s assigned quality controls duties as described in the CQC Plan. A single person can cover more than one area provided that the single person is qualified to perform QC activities in each designated and that workload allows.

EXPERIENCE MATRIX

Area	Qualifications
Civil	Graduate Civil Engineer or Construction Manager with 2 years experience in the type of work being performed on this project or technician with 5 years related experience.
Mechanical	Graduate Mechanical Engineer with 2 years experience or construction professional with 5 years of experience supervising mechanical features of work in the field with a construction company.
Electrical	Graduate Electrical Engineer with 2 years related experience or construction professional with 5 years of experience supervising electrical features of work in the field with a construction company.

Area	Qualifications
Structural	Graduate Civil Engineer (with Structural Track or Focus), Structural Engineer, or Construction Manager with 2 years experience or construction professional with 5 years experience supervising structural features of work in the field with a construction company.
Architectural	Graduate Architect with 2 years experience or construction professional with 5 years of related experience.
Environmental	Graduate Environmental Engineer with 3 years experience.
Submittals	Submittal Clerk with 1 year experience.
Concrete, Pavement, and Soils	Materials Technician with 2 years experience for the appropriate area.
Testing, Adjusting, and Balancing (TAB)	Specialist must be a member of AABC or an experienced technician of the firm certified by the NEBB.
Design Quality Control Manager	Registered Architect or Professional Engineer

D. Additional Requirements: In addition to the above experience and education requirements, the CQC System Manager and Alternate CQC System Manager are required to have completed the Construction Quality Management (CQM) for Construction course. If the CQC System Manager does not have a current specification, obtain the CQM for Contractors course identification within 90 days of award. This course is periodically offered by the Naval Facilities Engineering Command and the Army Corps of Engineers. Contact the Contracting Officer or Authorized designee for information on the next scheduled class.

E. Organizational Changes: Maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer or Authorized designee for acceptance.

3.5 **SUBMITTALS AND DELIVERABLES:** Submittals have to comply with the requirements in Section 01 33 23 Shop Drawings, Product Data, and Samples. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the contract requirements. When Section 01 91 00 General Commissioning Requirements

is included in the contract, the submittals required by the section have to be coordinated with the Section 01 33 23 Shop Drawings, Product Data, and Samples to ensure adequate time is allowed for each type of submittal required.

3.6 CONTROL:

A. CQC is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control are required to be conducted by the CQC System Manager for each definable feature of the construction work as follows:

1. Preparatory Phase: This phase is performed prior to beginning work on each definable feature of work after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase includes:
   a. A review of each paragraph of applicable specifications, references codes, and standards. Make available during the preparatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Government personnel until final acceptance of the work.
   b. Review of the Contract drawings.
   c. Check to assure that all materials and equipment have been tested, submitted, and approved.
   d. Review of provisions that have been made to provide required control inspection and testing.
   e. Review Special Inspections required by Section 01 45 35 Special Inspections, that Statement of Special Inspections and the Schedule of Specials Inspections.
   f. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the Contract.
   g. Examination of required materials, equipment, and sample work to assure that they are on hand conform to approved shop drawings or submitted data, and are properly stored.
   h. Review of the appropriate Activity Hazard Analysis (AHA) to assure safety requirements are met.

i. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards – contract defined or industry standard if not contract defined - for that feature of work.

j. Check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

k. Discussion of the initial control phase.

l. The Government needs to be notified at least 48 hours or 2 business days in advance of beginning the Preparatory control phase. Include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the Preparatory phase actions by separate minutes prepared by the CQC System Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

B. Initial Phase: This phase is accomplished at the beginning of a definable feature of work. Accomplish the following:

1. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the Preparatory meeting.
2. Verify adequacy of controls to ensure full contract compliance. Verify the required control inspection and testing is in compliance with the contract.
3. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
4. Resolve all differences.
5. Check safety to include compliance with an upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
6. The Government needs to be notified at least 48 hours or 2 business days in advance of beginning the initial phase for definable features of work. Prepare separate minutes of this phase by the CQC System Manager and attach to the daily CQC report. Indicate the

exact location of initial phase for definable feature of work for future reference and comparison with Follow-Up phases.

7. The initial phase for each definable feature of work is repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.
8. Coordinate scheduled work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections, and the Schedule of Special Inspections.

C. Follow-Up Phase: Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements until the completion of the particular feature of work. Record the checks in the CQC documentation. Conduct final Follow-Up checks and correct all deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work. Coordinate scheduled work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections, and the Schedule of Special Inspections

D. Additional Preparatory and Initial Phases on the same definable features of work if: the quality ongoing work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.7 TESTS

A. Testing Procedure: Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and acceptance test when specified. Procure the services of a Department of Veteran Affairs approved testing laboratory or establish an approved testing laboratory at the project site. Perform the following activities and record and provide the following data:

1. Verify that testing procedures comply with contract requirements.
2. Verify that facilities and testing equipment are available and comply with testing standards.
3. Check test instrument calibration data against certified standards.

4. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
5. Record results of all tests taken, both passing and failing on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the unique sequential control number identifying the test. If approved by the Contracting Officer or Authorized designee, actual test reports are submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer or Authorized designee. Failure to submit timely test reports as stated results in nonpayment for related work performed and disapproval of the test facility for this Contract.

B. Testing Laboratories: All testing laboratories must be validated through the procedures contained in Specification section 01 45 29 Testing Laboratory Services.
   1. Capability Check: The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician’s testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt and steel is required to meet criteria detailed in ASTM D3740 and ASTM E329.
   2. Capability Recheck: If the selected laboratory fails the capability check, the Contractor will be assessed a charge equal to value of recheck to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the Contract amount due the Contractor.

C. Onsite Laboratory: The Government reserves the right to utilize the Contractor’s control testing laboratory and equipment to make assurance tests, and to check the Contractor’s testing procedures, techniques, and test results at no additional cost to the Government.

3.8 COMPLETION INSPECTION

A. Punch-Out Inspection: Conduct an inspection of the work by the CQC system Manager near the end of the work, or any increment of the work established by the specifications. Prepare and include in the CQC

documentation a punch list of items which do not conform to the approved drawings and specifications. Include within the list of deficiencies the estimated date by which the deficiencies will be corrected. Make a second inspection the CQC System Manager or staff to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government Pre-Final Inspection.

B. Pre-Final Inspection: The Government will perform the Pre-Final Inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. Ensure that all items on this list have been corrected before notifying the Government, so that a Final Acceptance Inspection with the customer can be scheduled. Correct any items noted on the Pre-Final Inspection in a timely manner. These inspections and any deficiency corrections required by this paragraph need to be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate construction completion dates.

C. Final Acceptance Inspection: The Contractor’s QC Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer’s Authorized designee is required to be in attendance at the Final Acceptance Inspection. Additional Government personnel can also be in attendance. The Final Acceptance Inspection will be formally scheduled by the Contracting Officer’s or Authorized designee based upon results of the Pre-Final Inspection. Notify the Contracting Officer through the Resident Engineer office at least 14 days prior to the Final Acceptance Inspection and include the Contractor’s assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date schedule for the Final Acceptance Inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government’s additional inspection cost in accordance with FAR Clause 52.246-12 titled “Inspection of Construction”.

3.9 DOCUMENTATION

A. Quality Control Activities: Maintain current records providing factual evidence that required QC activities and tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:
   1. The name and area of responsibility of the Contractor/Subcontractor
   2. Operating plant/equipment with hours worked, idle, or down for repair.
   3. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
   4. Test and control activities performed with results and references to specification/drawing requirements. Identify the Control Phase (Preparatory, Initial, and/or Follow-Up). List deficiencies noted, along with corrective action.
   5. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specification/drawing requirements.
   6. Submittals and deliverables reviewed, with Contract reference, by whom, and action taken.
   7. Offsite surveillance activities, including actions taken.
   8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
   9. Instructions given/received and conflicts in plans and specifications.
   10. Provide documentation of design quality control activities. For independent design reviews, provide, as a minimum, identification of the Independent Technical Reviewer (ITR) team, the ITR review comments, responses, and the record of resolution of the comments.

B. Verification Statement: Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the Contract. Furnish the original and one copy of these records in report form to the Government daily with 1 week after the date covered by the report, except that reports need not be submitted for days on which no work is

performed. As a minimum, prepare and submit on report for every 7 days of no work and on the last day of a no work period. All calendar days need to be accounted for throughout the life of the contract. The first report following a day of no work will be for that day only. Reports need to be signed and dated by the CQC System Manager. Include copies of test reports and copies of reports prepared by all subordinate QC personnel within the CQC System Manager Report.

3.10 SAMPLE FORMS

Templates of various quality control reports can be found on the Whole Building Design Guide website at https://www.wbdg.org/FFC/NAVGRAPH/01%2045%2000.00%2020_quality_control_reports.pdf

3.11 **NOTIFICATION OF NONCOMPLIANCE:** The Contracting Officer or Authorized designee will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor should take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site will be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer can issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

--- End of Section ---

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:

D. Waste Management Plan development and implementation.

E. Techniques to minimize waste generation.

F. Sorting and separating of waste materials.

G. Salvage of existing materials and items for reuse or resale.

H. Recycling of materials that cannot be reused or sold.

I. 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. Sheathings
8. Cardboard, paper and packaging.
9. Bitumen roofing materials.
10. Plastics (eg, ABS, PVC).
11. Carpet and/or pad.
12. Gypsum board.
13. Insulation.
14. Paint.
15. 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.

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 COR 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.
            a) The names and locations of mixed debris reuse and recycling facilities or sites.
            b) The names and locations of trash disposal landfill facilities or sites.
            c) 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.

E. Target waste diversion rate by material and an overall diversion rate.

F. Final report documenting the results of implementation of the preconstruction waste management plan.

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. Green Building Initiative (GBI): Green Globes for New Construction 2019

1.7 RECORDS

A. 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 COR.

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 buildings, portions of buildings, utilities, other structures and debris from trash dumps shown.

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.

D. Construction Waste Management: Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT.

E. Infectious Control: Section 01 35 26, SAFETY 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 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 borders, fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

D. 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.

E. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
   1. No wall or part of wall shall be permitted to fall outwardly from structures.

   3. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
   4. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.

G. 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.

I. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS and Section 01 35 26, SAFETY REQUIREMENTS.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 DEMOLITION:

A. Completely demolish and removeas indicated on the drawings , including all appurtenances related or connected thereto, as noted below:

B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the Medical Center to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the COR. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

D. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations . All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 5feet below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 5 feet, or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.

E. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Resident Engineer. When Utility lines are encountered that are not indicated on the drawings, the Resident Engineer shall be notified prior to further work in that area.

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 off the Medical Center 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 03 30 53
(SHORT FORM) CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

Section Includes: .

A. Slab on grade infillO.

1.2 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this Section.

B. American Concrete Institute (ACI):

117-10(R2015).....Specification for Tolerances for Concrete Construction and Materials and Commentary

211.1-91(R2009).....Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.

211.2-98(R2004).....Standard Practice for Selecting Proportions for Structural Lightweight Concrete.

301/301M-16.....Specifications for Structural Concrete.

305.1-14 - .....Hot Weather Concreting.

306.1-90(R2002).....Cold Weather Concreting.

318/318M-19.....Building Code Requirements for Structural Concrete and Commentary

347R-14 - .....Guide to Formwork for Concrete.

SP-66-04-.....ACI Detailing Manual.

C. ASTM International(ASTM):

A615/A615M-20.....Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement

A996/A996M-16.....Standard Specification for Rail Steel and Axle Steel Deformed Bars for Concrete Reinforcement

A1064/A1064M-18a.....Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

C33/C33M-18.....Standard Specification for Concrete Aggregates.

C39/C39M-20.....Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

C94/C94M-20.....Standard Specification for Ready-Mixed Concrete.

C143/C143M-20.....Standard Test Method for Slump of Hydraulic Cement Concrete.

C150/C150M-20.....Standard Specification for Portland Cement.

C171-16.....Standard Specification for Sheet Materials for Curing Concrete.

C192/C192M-19.....Standard practice for Making and Curing Concrete Test Specimens in the Laboratory.

C219-20a.....Standard Terminology Relating to Hydraulic and Other Inorganic Cements.

C260/C260M-10a(2016)....Standard Specification for Air-Entraining Admixtures for Concrete.

C330/C330M-17a.....Standard Specification for Lightweight Aggregates for Structural Concrete.

C494/C494M-19.....Standard Specification for Chemical Admixtures for Concrete.

C618-19 .....Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

C881/C881M-20 .....Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

C989/C989M-18a .....Standard Specification for Slag Cement for Use in Concrete and Mortars.

C1240-20 .....Standard Specification for Silica Fume Used in Cementitious Mixtures.

D1751-18 .....Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

E1155-20.....Determining FF Floor Flatness and FL Floor Levelness Numbers.

E1745-17 .....Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

D. International Concrete Repair Institute:

310.2R-2013 -.....Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.3 SUBMITTALS (PRE-BAGGED CONCRETE MIX BASIS OF DESIGN QUIKRETE 5000 CONCRETE MIX OR EQUAL)

A. Submittal Procedures: Refer to Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer’s Representative (COR) review and approval.

B. Manufacturer's Literature and Data:

1. Concrete Mix Design.
2. Air-entraining admixture, chemical admixtures, and curing compounds.
3. Indicate manufacturer's recommendation for each application.

C. Certificates: Show on-site mixing reports that comply with the manufacturer’s recommendation. See drawings for sample form on sheet GC702.

1.4 DELIVERY

A. Deliver each concrete batch with mix certification in duplicate according to ASTM International(ASTM) C94/C94M.

1.5 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. POLYMER MODIFIED AND SHRINKAGE COMPENSATED, HYDRAULIC CEMENT BASED ONE COMPONENT CONCRETE RESURFACER. COMPLY WITH THE FOLLOWING:

1. MANUFACTURER: CONCRETE RESURFACER AS MANUFACTURED BY THE QUIKRETE® COMPANIES OR APPROVED EQUAL.
2. PERFORMANCE AND PHYSICAL PROPERTIES AT 73 DEGREES F AND 50 PERCENT RELATIVE HUMIDITY:
   A. COMPRESSIVE STRENGTH, ASTM C 109 (AIR CURED): 1000 PSI (6.9 MPA) @ 24 HOURS, 3000 PSI (20.71 MPA) @ 7 DAYS AND 4500 PSI (31.0 MPA) @ 28 DAYS
   B. LENGTH CHANGE, ASTM C 157 MODIFIED: STORED IN WATER < +0.15% STORED IN AIR < - 0.15%
   C. WALK ON TIME: 6 HOURS

B. Vapor Barrier: ASTM International(ASTM) E1745, Class A with a minimum puncture resistance of 2200 g (3000 pounds); minimum 0.38 mm (15 mil) thick.

C. Reinforcing Steel: ASTM International(ASTM) A615/A615M or ASTM International(ASTM) A996/A996M, deformed.

D. Forms: metal, or other materials, approved by Contracting Officer Representative , of grade or type suitable to obtain type of finish specified.

2.2 ACCESSORIES

A. Bonding Agent: ASTM International (ASTM) C 1059/C 1059M, Type II.

B. Structural Adhesive: ASTM International (ASTM) C881, 2-component material suitable for use on dry or damp surfaces. Provide material Type, Grade, and Class to suit Project requirements.

2.3 CONCRETE MIXES

A. Design concrete mixes according to ASTM International (ASTM) C94/C94M, Option C.

B. Compressive strength at 28 days: minimum 3000 psi).

PART 3 - EXECUTION

3.1 FORMWORK

A. Installation: Conform to ACI 347. Construct forms to obtain concrete of the shapes, dimensions and profiles indicated, with tight joints.

B. Design and construct forms to prevent bowing-out of forms between supports and to be removable without prying against or otherwise damaging fresh concrete.

C. When patching formed concrete, seal form edges against existing surface to prevent leakage; set forms so that patch is flush with adjacent surfaces.

D. Inserts, Sleeves, and Similar Items: Install anchors, inserts, wires, sleeves, and other cast-in items specified in other Sections. Place where indicated, square, flush and secured to formwork.

3.2 PLACING CONCRETE

A. Remove hardened concrete, debris and other foreign materials from interior of forms, and from inside of mixing and conveying equipment. Obtain approval from Contracting Officer's Representative before placing concrete.

B. Install screeds at required elevations for concrete slabs.

C. Roughen and clean free from laitance, foreign matter, and loose particles before placing new concrete on existing concrete.

1. Blow-out areas with compressed air and immediately coat contact areas with adhesive in compliance with manufacturer's instructions.

D. Place structural concrete according to ACI 301 and ACI 318.

E. Convey concrete from mixer to final place of deposit by method that will prevent segregation or loss of ingredients. Do not deposit, in Work, concrete that has attained its initial set or has contained its water or cement more than 1 1/2 hours. Do not allow concrete to drop freely more than 1500 mm (5 feet) in unexposed work nor more than 900 mm (3 feet) in exposed work.

F. Place and consolidate concrete in horizontal layers not exceeding 12 inches in thickness. Consolidate concrete by spading, rodding, and mechanical vibrator. Do not secure vibrator to forms or reinforcement. Continuously vibrate during placement of concrete.

G. Hot Weather Concrete Placement: As recommended by ACI 305.1 to prevent adversely affecting properties and serviceability of hardened concrete.

H. Cold Weather Concrete Placement: As recommended by ACI 306.1, to prevent freezing of thin sections less than 300 mm (12 inches) and to permit concrete to gain strength properly.

1. Do not use calcium chloride without written approval from Contracting Officer's Representative.

3.3 TOLERANCES

A. Slab on Grade Finish Tolerance: Comply with ACI 117, FF-number and FL-number method.

1. Paragraph 4.8.3, Class A 3 mm (1/8 inches) for offset in form-work.
2. Table R4.8.4, "Flat" 6 mm (1/4 inch) in 3 m (10 feet) for slabs.

3.4 PROTECTION AND CURING

A. Protect exposed surfaces of concrete from premature drying, wash by rain or running water, wind, mechanical damage, and excessive hot or cold temperatures.

B. Curing Methods: Cure concrete with curing compound using wet method with sheets.

C. Formed Concrete Curing: Wet the tops and exposed portions of formed concrete and keep moist until forms are removed.

1. If forms are removed before 14 days after concrete is cast, install sheet curing materials as specified above.

D. Concrete Flatwork Curing:

1. Install sheet materials according to the manufacturer's instructions.

a. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.5 FORM REMOVAL

A. Maintain forms in place until concrete is self-supporting, with construction operation loads.

B. Remove fins, laitance and loose material from concrete surfaces when forms are removed. Repair honeycombs, rock pockets, sand runs, spalls, or otherwise damaged surfaces by patching with the same mix as concrete minus the coarse aggregates.

C. Finish to match adjacent surfaces.

3.6 FINISHES

A. Vertical and Overhead Surface Finishes:

1. Surfaces Concealed in Completed Construction: As-cast; no additional finishing required.
2. Surfaces Exposed in Unfinished Areas: As-cast; no additional finishing required.
   a. Mechanical rooms.
   b. Electrical rooms.
3. Surfaces Exposed to View Scheduled for Paint Finish: Remove fins, burrs and similar projections by mechanical means approved by Contracting Officer's Representative flush with adjacent surface. Lightly rub with fine abrasive stone or hone. Use ample amount of water during rubbing without working up a lather of mortar or changing texture of concrete.
4. Surfaces Exposed to View in Finished Areas: Grout finish, unless otherwise shown, for uniform color and smooth finish treated.
   a. Remove laitance, fins and burrs.
   b. Scrub concrete with wire brushes. Clean stained concrete surfaces with hone or stone.
   c. Apply grout composed of 1 part Portland cement and 1 part clean, fine sand (smaller than 600 micro-m (No. 30) sieve). Work grout into surface of concrete with cork floats or fiber brushes until pits and honeycomb are filled.
   d. After grout has hardened, but is still plastic, remove surplus grout with sponge rubber float and by rubbing with clean burlap.

e. In hot, dry weather fog spray surfaces with water to keep grout wet during setting period. Complete finished areas in same day. Confine limits of finished areas to natural breaks in wall surface. Do not leave grout on concrete surface overnight.

B. Slab Finishes:

1. Allow bleed water to evaporate before surface is finished. Do not sprinkle dry cement on surface to absorb water.
2. Scratch Finish: Rake or wire broom after partial setting slab surfaces to received bonded applied cementitious application, within 2 hours after placing, to roughen surface and provide permanent bond between base slab and applied cementitious materials.
3. Float Finish: Interior ramps, interior stair treads, and platforms, both equipment pads, and slabs to receive non-cementitious materials, except as specified.
   a. Screen and float to smooth dense finish.
   b. After first floating, while surface is still soft, check surfaces for alignment using straightedge or template. Correct high spots by cutting down with trowel or similar tool. Correct low spots by filling in with material same composition as floor finish. Remove any surface projections on floated finish by rubbing or dry grinding. Refloat slab to uniform sandy texture.
4. Steel Trowel Finish: Applied toppings, concrete surfaces to receive resilient floor covering or carpet, future floor roof and other monolithic concrete floor slabs exposed to view without other finish indicated or specified.
   a. Delay final steel troweling to secure smooth, dense surface, usually when surface can no longer be dented by fingers. During final troweling, tilt steel trowel at slight angle and exert heavy pressure on trowel to compact cement paste and form dense, smooth surface.
   b. Finished surface: Free from trowel marks. Uniform in texture and appearance.
5. Broom Finish: Finish exterior slabs, ramps, and stair treads with bristle brush moistened with clear water after surfaces have been floated.
6. Finished Slab Flatness (FF) and Levelness (FL):

a. Slab on Grade: Specified overall value FF 25/FL 20. Minimum local value FF 17/FL 15.

b. Test flatness and levelness according to ASTM E1155.

3.7 SURFACE TREATMENTS

A. Mix and apply the following surface treatments according to manufacturer's instructions.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Liquid Densifier/Sealer: Use for exposed concrete floors and concrete floors to receive carpeting

C. Slip Resistant Finish:

1. Except where safety nosing and tread coverings are shown, apply abrasive aggregate to treads and platforms of concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms.

a. Broadcast aggregate uniformly over concrete surface. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water sufficiently to slightly expose abrasive aggregate.

3.8 APPLIED TOPPING

A. Install concrete topping with thickness and strength shown with only enough water to ensure stiff, workable, plastic mix.

B. Continuously place applied topping until entire area is complete, struck off with straightedge, compact by rolling or tamping, float and steel trowel to hard smooth finish.

3.9 RESURFACING FLOORS

A. Remove existing flooring by abrasive blasting or grinding, in areas to receive resurfacing, to expose existing structural slab. Achieve a surface profile of 2 to 4 according to ICRI 310.2R for the condition found at Site.

B. Prepare exposed structural slab surface by cleaning, wetting, and applying adhesive according to manufacturer's instructions as specified in the flooring section.

- - E N D - -

SECTION 07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide UL or equivalent approved firestopping system for the closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction.

B. Provide UL or equivalent approved firestopping system for the closure of openings in walls against penetration of gases or smoke in smoke partitions.

1.2 RELATED WORK

A. Section 07 92 00, JOINT SEALANTS: Sealants and application.

B. Section 23 31 00, HVAC DUCTS AND CASINGS: Fire and smoke damper assemblies in ductwork.

C. Section 23 37 00, AIR OUTLETS AND INLETS: Fire and smoke damper assemblies in ductwork.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Installer qualifications.

C. Inspector qualifications.

D. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.

E. List of FM, UL, or WH classification number of systems installed.

F. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.

G. Submit certificates from manufacturer attesting that firestopping materials comply with the specified requirements.

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 QUALITY ASSURANCE

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

B. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991 or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements." Submit qualification data.

C. Inspector Qualifications: Contractor to engage a qualified inspector to perform inspections and final reports. The inspector to meet the criteria contained in ASTM E699 for agencies involved in quality assurance and to have a minimum of two years' experience in construction field inspections of firestopping systems, products, and assemblies. The inspector to be completely independent of, and divested from, the Contractor, the installer, the manufacturer, and the supplier of material or item being inspected. Submit inspector qualifications.

1.6 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. ASTM International (ASTM):

E84-20.....Surface Burning Characteristics of Building Materials

E699-16.....Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components

E814-13a(2017).....Fire Tests of Penetration Firestop Systems

E2174-20a.....Standard Practice for On-Site Inspection of Installed Firestop Systems

E2393-20.....Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

C. FM Global (FM):

Annual Issue Approval Guide Building Materials

4991-13.....Approval of Firestop Contractors

D. Underwriters Laboratories, Inc. (UL):

Annual Issue Building Materials Directory

E. Annual Issue Fire Resistance Directory

723-Edition 11(2018)....Standard for Test for Surface Burning Characteristics of Building Materials

1479-04(2015).....Fire Tests of Penetration Firestops

F. Intertek Testing Services - Warnock Hersey (ITS-WH):
Annual Issue Certification Listings

G. Environmental Protection Agency (EPA):
40 CFR 59(2014).....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 FIRESTOP SYSTEMS

A. Provide 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. Firestop systems to accommodate building movements without impairing their integrity.

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 4 inches nominal pipe or 0.01 square meter (16 square inches) in overall cross sectional area.

C. Firestop sealants used for firestopping or smoke sealing to have the following properties:

1. Contain no flammable or toxic solvents.
2. Color: Fire stop material shall be Hilti Red or approved equal.
3. Release no dangerous or flammable out gassing during the drying or curing of products.
4. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
5. When installed in exposed areas, capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
6. VOC Content: Firestopping sealants and sealant primers to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
   a. Sealants: 250 g/L.
   b. Sealant Primers for Nonporous Substrates: 250 g/L.
   c. Sealant Primers for Porous Substrates: 775 g/L.

D. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials to 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.
E. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84 or UL 723. Material to be an approved firestopping material as listed in UL Fire Resistance Directory or by a nationally recognized testing laboratory.
F. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
G. Materials to be nontoxic and noncarcinogen at all stages of application or during fire conditions and to not contain hazardous chemicals. Provide firestop material that is free from Ethylene Glycol, PCB, MEK, and asbestos.
H. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
   1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
   2. For floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means acceptable to the firestop manufacturer.
   3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

2.2 SMOKE STOPPING IN SMOKE PARTITIONS

A. Provide silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.
B. Provide mineral fiber filler and bond breaker behind sealant.
C. Sealants to have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with ASTM 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

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

B. Examine substrates and conditions with installer present for compliance with requirements for opening configuration, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove dirt, grease, oil, laitance and form-release agents from concrete, 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 6 inches on each 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.

C. Prime substrates where required by joint firestopping system manufacturer using that manufacturer’s recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

D. Masking Tape: Apply masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing seal of firestopping with substrates.

3.3 INSTALLATION

A. Do not begin firestopping 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

A. As work on each floor is completed, remove materials, litter, and debris.

B. Clean up spills of liquid type materials.

C. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

D. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to provide firestopping complying with specified requirements.

3.5 INSPECTIONS AND ACCEPTANCE OF WORK

A. Do not conceal or enclose firestop assemblies until inspection is complete and approved by the Contracting Officer Representative (COR).

B. Furnish service of approved inspector to inspect firestopping in accordance with ASTM E2393 and ASTM E2174 for firestop inspection, and document inspection results. Submit written reports indicating locations of and types of penetrations and type of firestopping used at each location; type is to be recorded by UL listed printed numbers.

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SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section covers interior and exterior sealant and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK (INCLUDING BUT NOT LIMITED TO THE FOLLOWING):

D. Firestopping Penetrations: Section 07 84 00, FIRESTOPPING.

H. Mechanical Work: Section 22 05 11 COMMON WORK RESULTS FOR PLUMBING.

1.3 QUALITY ASSURANCE:

A. Installer Qualifications: An experienced installer with a minimum of three (3) years' experience and 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. Submit qualification.

B. Source Limitations: Obtain each type of joint sealant through one (1) 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.
4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

D. Lab Tests: Submit samples of materials that will be in contact or affect joint sealants to joint sealant manufacturers for tests as follows:

1. Adhesion Testing: Before installing elastomeric sealants, test their adhesion to protect joint substrates according to the method in

ASTM C794 to determine if primer or other specific joint preparation techniques are required.

2. Compatibility Testing: Before installing elastomeric sealants, determine compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Perform testing per ASTM C1248 on interior and exterior sealants to determine if sealants or primers will stain adjacent surfaces. No sealant work is to start until results of these tests have been submitted to the Contracting Officer Representative (COR) and the COR has given written approval to proceed with the work.

F. Mockups: See Drawings for Mockup.

1.4 CERTIFICATION:

A. Contractor is to submit to the COR written certification that joints are of the proper size and design, that the materials supplied are compatible with adjacent materials and backing, that the materials will properly perform to provide permanent watertight, airtight or vapor tight seals (as applicable), and that materials supplied meet specified performance requirements.

1.5 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Installer qualifications.

D. Contractor certification.

E. Manufacturer's installation instructions for each product used.

F. Cured samples of exposed sealants for each color.

G. Manufacturer's Literature and Data:

1. Primers
2. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

H. Manufacturer warranty.

1.6 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 degrees C (40 degrees 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.

1.7 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 degrees C (90 degrees F) or less than 5 degrees C (40 degrees F).

1.8 DEFINITIONS:

A. Definitions of terms in accordance with ASTM C717 and as specified.

B. Backing 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.

1.9 WARRANTY:

A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".

B. Manufacturer Warranty: Manufacturer shall warranty their sealant for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty.

1.10 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. ASTM International (ASTM):

C509-06.....Elastomeric Cellular Preformed Gasket and Sealing Material

C612-14.....Mineral Fiber Block and Board Thermal Insulation

C717-14a.....Standard Terminology of Building Seals and Sealants

C734-06(R2012).....Test Method for Low-Temperature Flexibility of Latex Sealants after Artificial Weathering

C794-10.....Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants

C919-12.....Use of Sealants in Acoustical Applications.

C920-14a.....Elastomeric Joint Sealants.

C1021-08(R2014).....Laboratories Engaged in Testing of Building Sealants

C1193-13.....Standard Guide for Use of Joint Sealants.

C1248-08(R2012).....Test Method for Staining of Porous Substrate by Joint Sealants

C1330-02(R2013).....Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants

C1521-13.....Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints

D217-10.....Test Methods for Cone Penetration of Lubricating Grease

D1056-14.....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

D. Environmental Protection Agency (EPA):
40 CFR 59(2014).....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 SEALANTS:

A. Exterior Sealants:

1. Vertical surfaces, provide non-staining ASTM C920, Type S or M, Grade NS, Class 25, Use NT.

2. Horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T.
3. Provide location(s) of exterior sealant as follows:
   a. Joints formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Provide sealant at exterior surfaces of exterior wall penetrations.
   b. Metal to metal.
   c. Masonry to masonry or stone.
   d. Stone to stone.
   e. Cast stone to cast stone.
   f. Masonry expansion and control joints.
   g. Wood to masonry.
   h. Masonry joints where shelf angles occur.
   i. Voids where items penetrate exterior walls.
   j. Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.

B. Floor Joint Sealant:
1. ASTM C920, Type S or M, Grade P, Class 25, Use T.
2. S-# Provide location(s) of floor joint sealant as follows.
   a. Seats of metal thresholds exterior doors.
   b. Control and expansion joints in floors, slabs, ceramic tile, and walkways.

C. Interior Sealants:
1. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system are to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
   a. Architectural Sealants: 250 g/L.
   b. Sealant Primers for Nonporous Substrates: 250 g/L.
   c. Sealant Primers for Porous Substrates: 775 g/L.
2. Vertical and Horizontal Surfaces: ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
3. Food Service: Use a Vinyl Acetate Homopolymer, or other low VOC, non-toxic sealant approved for use in food preparation areas.
4. Provide location(s) of interior sealant as follows:

a. Typical narrow joint 1/4 inch or less at walls and adjacent components.
b. Perimeter of doors, windows, access panels which adjoin concrete or masonry surfaces.
c. Interior surfaces of exterior wall penetrations.
d. Joints at masonry walls and columns, piers, concrete walls or exterior walls.
e. Perimeter of lead faced control windows and plaster or gypsum wallboard walls.
f. Exposed isolation joints at top of full height walls.
g. Joints between bathtubs and ceramic tile; joints between shower receptors and ceramic tile; joints formed where nonplanar tile surfaces meet.
h. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.
i. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.

D. Acoustical Sealant:
1. Conforming to ASTM C919; flame spread of 25 or less; and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Acoustical sealant have a consistency of 250 to 310 when tested in accordance with ASTM D217; remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734; and be non-staining.
2. Provide location(s) of acoustical sealant as follows:
a. Exposed acoustical joint at sound rated partitions.
b. Concealed acoustic joints at sound rated partitions.
c. Joints where item pass-through sound rated partitions.

2.2 COLOR:

A. Sealants used with exposed masonry are to match color of mortar joints.
B. Sealants used with unpainted concrete are to match color of adjacent concrete.
C. Color of sealants for other locations to be light gray or aluminum, unless otherwise indicated in construction documents.

2.3 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 or synthetic rubber (ASTM C509), nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32 degrees C (minus 26 degrees 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 fiberboard: 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 POROUS SURFACES:

A. Chemical cleaners compatible with sealant and acceptable to manufacturer of sealants and sealant backing material. Cleaners to be 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 (The Professionals’ Guide).

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 but are not limited to 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. Nonporous surfaces include but are not limited to the following:

a. Metal.

b. Glass.

c. Porcelain enamel.

d. Glazed surfaces of ceramic tile.

C. Do not cut or damage joint edges.

D. Apply non-staining 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 or as indicated by pre-construction joint sealant substrate test.
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. Avoid application to or spillage onto adjacent substrate surfaces.

3.3 BACKING INSTALLATION:

A. Install backing 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 backing rod and position the rod at proper depth.
C. Cut fillers installed by others to proper depth for installation of backing rod and sealants.
D. Install backing rod, without puncturing the material, to a uniform depth, within plus or minus 1/8 inch for sealant depths specified.
E. Where space for backing rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

3.4 SEALANT DEPTHS AND GEOMETRY:

A. At widths up to 1/4 inch, sealant depth equal to width.
B. At widths over 1/4 inch, sealant depth 1/2 of width up to 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 degrees 40 degrees and 100 degrees F.
2. Do not install 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 install 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 exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 5A in ASTM C1193 unless shown or specified otherwise in construction documents. Remove masking tape immediately after tooling of sealant and before sealant face starts to “skin” over. Remove any excess sealant from adjacent surfaces of joint, leaving the working in a clean finished condition.
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. Submit test reports.
11. Replace sealant which is damaged during construction process.

C. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise. Take all necessary steps to prevent three-sided adhesion of sealants.

D. Interior Sealants: 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 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 1/4 inch bead of sealant around all cutouts 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:

3.7 CLEANING:

A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by manufacturer of the adjacent material or if not otherwise indicated by the caulking or sealant manufacturer.
B. Leave adjacent surfaces in a clean and unstained condition.

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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 interior concrete block exposed to view.
7. Painting gypsum drywall exposed to view.
8. 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.
9. Painting pipes, pipe coverings, conduit, ducts, insulation, hangers, supports and other mechanical and electrical items and equipment exposed to view.
10. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers lighting fixtures, and the like, which are exposed to view through these items.
11. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.
12. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
13. 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. Section 01 35 26, SAFETY REQUIREMENTS: Activity Hazard Analysis.

B. Division 05 METALS: Shop prime painting of steel and ferrous metals.

C. Division 08 OPENINGS: Shop prime painting of steel and ferrous metals.

D. Division 14 CONVEYING EQUIPMENT: Shop prime painting of steel and ferrous metals.

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.

D. 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, 4 x 10 inch.
3. Panel to Show Transparent Finishes: Wood of same species and grain pattern as wood approved for use, 4 x 10 inch face minimum, and where both flat and edge grain will be exposed, 250 mm (10 inches) long by sufficient size, 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. Product type and color.
   c. Name of project.

5. Strips showing not less than 2 inch wide strips of undercoats and 4 inch wide strip of finish coat.

E. Sample of identity markers if used.

F. Manufacturers' Certificates indicating compliance with specified requirements:

1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
2. High temperature aluminum paint.
3. Epoxy coating.
4. Intumescent clear coating or fire-retardant paint.
5. Plastic floor 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 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 **MOCK-UP PANEL (SEE DRAWINGS FOR DETAILS_)**

A. In addition to the samples specified herein to be submitted for approval, apply in the field, at their final location, each type and color of approved paint materials, applied 10 feet wide, floor to ceiling of wall surfaces, before proceeding with the remainder of the work, for approval by the COR. Paint mock-ups to include one (1) door and frame assembly.

B. Finish and texture approved by COR will be used as a standard of quality and workmanship for remainder of work.

C. Repaint individual areas which are not approved, as determined by the COR, until approval is received.

1.7 **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.

1.8 **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.

1.9 **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
3.....Primer, Alkali Resistant, Water Based
4.....Interior/ Exterior Latex Block Filler
5.....Exterior Alkyd Wood Primer
6.....Exterior, Latex for Exterior Wood Primer
7.....Exterior Oil Wood Primer
8.....Exterior Alkyd, Flat MPI Gloss Level 1
9.....Exterior Alkyd Enamel MPI Gloss Level 6
10.....Exterior Latex, Flat
11.....Exterior Latex, Semi-Gloss
15.....Exterior Latex, Low Sheen (MPI Gloss Level 3-4)
17.....Primer, Bonding, Waterbased
18.....Organic Zinc Rich Primer
22.....Aluminum Paint, High Heat (up to 590% - 1100F)
23.....Primer, Metal, Surface Tolerant

27.....Exterior / Interior Alkyd Floor Enamel, Gloss
31.....Polyurethane, Moisture Cured, Clear Gloss
36.....Knot Sealer
39.....Primer, Latex, for Interior Wood
40.....Exterior, Latex High Build
42.....Textured Coating, Latex, Flat
43.....Interior Satin Latex, MPI Gloss Level 4
44.....Interior Low Sheen Latex, MPI Gloss Level 2
45.....Interior Primer Sealer
46.....Interior Enamel Undercoat
47.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5
48.....Interior Alkyd, Gloss, MPI Gloss Level 6

50.....Interior Latex Primer Sealer
51.....Interior Alkyd, Eggshell, MPI Gloss Level 3
52.....Interior Latex, MPI Gloss Level 3
53.....Interior Latex, Flat, MPI Gloss Level 1
54.....Interior Latex, Semi-Gloss, MPI Gloss Level 5
59.....Interior/Exterior Alkyd Porch & Floor Enamel, Low Gloss
60.....Interior/Exterior Latex Porch & Floor Paint, Low Gloss
66.....Interior Alkyd Fire Retardant, Clear Top-Coat (ULC Approved)
67.....Interior Latex Fire Retardant, Top-Coat (ULC Approved)
68.....Interior/ Exterior Latex Porch & Floor Paint, Gloss
71.....Polyurethane, Moisture Cured, Clear, Flat
77.....Epoxy Cold Cured, Gloss
79.....Marine Alkyd Metal Primer
90.....Interior Wood Stain, Semi-Transparent
91.....Wood Filler Paste
94.....Exterior Alkyd, Semi-Gloss
95.....Fast Drying Metal Primer
98.....High Build Epoxy Coating
99.....Sealer, Water-based, for Concrete Floors
101.....Epoxy Anti-Corrosive Metal Primer
107.....Primer, Rust-Inhibitive, Water-based

108.....High Build Epoxy Coating, Low Gloss
113.....Elastomeric, Pigmented, Exterior, Water-based, Flat
114.....Interior Latex, Gloss
115.....Epoxy-Modified Latex, Interior Gloss (MPI gloss level 6)
118.....Dry Fall, Latex Flat
119.....Exterior Latex, High Gloss (acrylic)
134.....Galvanized Water Based Primer
135.....Non-Cementitious Galvanized Primer

138.....Interior High Performance Latex, MPI Gloss Level 2

139.....Interior High Performance Latex, MPI Gloss Level 3

140.....Interior High Performance Latex, MPI Gloss Level 4

141.....Interior High Performance Latex (SG) MPI Gloss Level 5

144.....Latex, Interior, Institutional Low Odor / VOC, (MPI Gloss Level 2)

145.....Latex, Interior, Institutional Low Odor / VOC, (MPI Gloss Level 3)

146.....Latex, Interior, Institutional Low Odor / VOC, (MPI Gloss Level 4)

151.....Light Industrial Coating, Interior, Water-based, (MPI Gloss Level 3)

153.....Light Industrial Coating, Interior, Water-based, (MPI Gloss Level 4)

163.....Exterior Water Based Semi-Gloss Light Industrial Coating, MPI Gloss Level 5

164.....Exterior, Water Based, Gloss, Light Industrial Coating, MPI Gloss Level 6

H. 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

I. Maple Flooring Manufacturer’s Association (MFMA):

J. U.S. National Archives and Records Administration (NARA):

29 CFR 1910.1000.....Air Contaminants

K. 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 gram/liter.
2. Non-flat Paints and Coatings: 150 gram/liter.
3. Dry-Fog Coatings: 400 gram/liter.
4. Primers, Sealers, and Undercoaters: 200 gram/liter.
5. Anticorrosive and Antirust Paints applied to Ferrous Metals: 250 gram/liter.
6. Zinc-Rich Industrial Maintenance Primers: 340 gram/liter.
7. Pretreatment Wash Primers: 420 gram/liter.
8. Shellacs, Clear: 730 gram/liter.
9. Shellacs, Pigmented: 550 gram/liter.

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. Widths as shown on construction documents.

2.4 **BIOBASED CONTENT**

A. Paint products shall comply with following bio-based standards for biobased materials:

Material Type	Percent by Weight
Interior Paint	20 percent biobased material
Interior Paint- Oil Based and Solvent Alkyd	67 percent biobased material
Exterior Paint	20 percent biobased material
Wood & Concrete Stain	39 percent biobased content
Polyurethane Coatings	25 percent biobased content
Water Tank Coatings	59 percent biobased content
Wood & Concrete Sealer-Membrane Concrete Sealers	11 percent biobased content
Wood & Concrete Sealer-Penetrating Liquid	79 percent biobased content

B. The minimum-content standards are based on the weight (not the volume) of the material.

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. Do no exterior painting when it is windy and dusty.

4. Do not paint in direct sunlight or on surfaces that the sun will warm.
5. 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.
6. 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.

I. All suction spots or “hot spots” in plaster after the application of the first coat are to be touched up before applying the second coat.

J. Do not apply paint behind frameless mirrors that use mastic for adhering to wall surface.

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. Masonry (Clay and CMU’s): 12 percent.
d. Wood: 15 percent.
e. Gypsum Board: 12 percent.
f. Plaster: 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. Surface painted with an opaque finish:
   a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
   b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
5. 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 doors and frames, access panels, roll-up steel doors 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, Aluminum, Copper and Copper Alloys 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. Masonry, Concrete, Cement Board, Cement Plaster and Stucco:

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. Remove loose mortar in masonry work.

4. 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.

5. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces as specified in Division 03, CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.

F. Gypsum Plaster and Gypsum Board:

1. Remove efflorescence, loose and chalking plaster 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 new or 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 except for exterior exposed steel apply an additional prime coat.

D. Prime rabbets for stop and face glazing of wood, and for face glazing of steel.

E. Wood and Wood Particleboard:

1. Use same kind of primer specified for exposed face surface.
   a. Exterior wood: MPI 7 (Exterior Oil Wood Primer) for new construction and MPI 5(Exterior Alkyd Wood Primer) for repainting bare wood primer except where MPI 90 (Interior Wood Stain, Semi-Transparent) is scheduled.
   b. Interior wood except for transparent finish: MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat), thinned if recommended by manufacturer.
   c. Transparent finishes as specified under "Transparent Finishes on Wood Except Floors Article"
2. Apply two (2) coats of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) to surfaces of wood doors, including top and bottom edges, which are cut for fitting or for other reason.
3. Apply one (1) coat of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) as soon as delivered to site to surfaces of unfinished woodwork, except concealed surfaces of shop

fabricated or assembled millwork and surfaces specified to have varnish, stain or natural finish.

4. Back prime and seal ends of exterior woodwork, and edges of exterior plywood specified to be finished.
5. Apply MPI 67 (Interior Latex Fire Retardant, Top-Coat (UL Approved) to wood for fire retardant finish.

F. Metals except boilers, incinerator stacks, and engine exhaust pipes:

1. Steel and iron: MPI 79 (Marine Alkyd Metal Primer) MPI 95 (Fast Drying Metal Primer) . Use MPI 101 (Cold Curing Epoxy Primer) where MPI 77 (Epoxy Cold Cured, Gloss MPI 98 (High Build Epoxy Coating) MPI 108 (High Build Epoxy Marine Coating finish is specified.
2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer) MPI 135 (Non-Cementitious Galvanized Primer).
3. Aluminum scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
4. Copper and copper alloys scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
5. Machinery not factory finished: MPI 9 (Exterior Alkyd Enamel).
6. Asphalt coated metal: MPI 1 (Aluminum Paint).
7. Metal over 94 degrees C (201 degrees F), Boilers, Incinerator Stacks, and Engine Exhaust Pipes: MPI 22 (High Heat Resistant Coating).

G. Gypsum Board:

1. Primer: MPI 50 (Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer)
2.

H. Machinery without factory finish except for primer: One (1) coat MPI 9 (Exterior Alkyd Enamel) MPI 94 (Exterior Alkyd, Semi-Gloss).

I. Concrete Masonry Units Concrete:

1. General:
   a. Where specified or shown.
   b. Mix as specified in manufacturer's printed directions.
   c. Do not mix more paint than can be used within four (4) hours after mixing. Discard paint that has started to set.
   d. Dampen warm surfaces above 24 degrees C (75 degrees F) with fine mist of water before application of paint. Do not leave free water on surface.

e. Cure paint with a fine mist of water as specified in manufacturer's printed instructions.

2. Use two (2) coats of TT-P-1411 (Paint, Co-polymer-Resin, Cementitious), unless specified otherwise.

3.8 **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.
   b. Two (2) coats of MPI 51 (Interior Alkyd, Eggshell).
   c. One (1) coat of MPI 46 (Interior Enamel Undercoat) plus one coat of MPI 47 (Interior Alkyd, Semi-Gloss) on exposed interior surfaces of alkyd-amine enamel prime finished windows.
   d. Machinery: One (1) coat MPI 9 (Exterior Alkyd Enamel).
   e. Asphalt Coated Metal: One (1) coat MPI 1 (Aluminum Paint).
   f. Ferrous Metal over 94 degrees K (290 degrees F): Boilers, Incinerator Stacks, and Engine Exhaust Pipes: One (1) coat MPI 22 (High Heat Resistant Coating.

C. Masonry and Concrete Walls:

1. Over MPI 4 (Interior/Exterior Latex Block Filler) on CMU surfaces.
2. Two (2) coats of MPI 53 (Interior Latex, Flat, MPI Gloss Level 1) MPI 52 (Interior Latex, MPI Gloss Level 3) MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) MPI 114 (Interior Latex, Gloss).
3. Two (2) coats of MPI 138 (Interior High Performance Latex, MPI Gloss Level 2) MPI 139 (Interior High Performance Latex, MPI Gloss Level 3) MPI 140 (Interior High Performance Latex MPI Gloss Level 4) MPI 141 (Interior High Performance Latex MPI Gloss Level 5) MPI 114 (Interior Latex, Gloss).

D. 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.

3. Transparent Finishes on Wood Except Floors.

a. Natural Finish:

One (1) coat of sealer MPI 31 (gloss) MPI 71 (flat) thinned with thinner recommended by manufacturer at rate of one (1) part of thinner to four (4) parts of varnish.

Two (2) coats of MPI 71 (Polyurethane, Moisture Cured, Clear Flat MPI 31 (Polyurethane, Moisture Cured, Clear Gloss.

1.

b. Stain Finish:

One (1) coat of MPI 90 (Interior Wood Stain, Semi-Transparent).

Use wood stain of type and color required to achieve finish specified. Do not use varnish type stains.

One (1) coat of sealer MPI 31 (gloss) MPI 71 (flat) thinned as recommended by manufacturer at rate of one (1) part of thinner to four (4) parts of varnish.

Two (2) coats of MPI 71 (Polyurethane, Moisture Cured, Clear Flat) MPI 31 (Polyurethane Moisture Cured, Clear Gloss).

c. Varnish Finish:

One (1) coat of sealer MPI 31 (gloss) MPI 71 (flat) thinned as recommended by manufacturer at rate of one (1) part of thinner to four (4) parts of varnish.

Two (2) coats of MPI 71 (Polyurethane, Moisture Cured, Clear Flat) MPI 31 (Polyurethane Moisture Cured, Clear Gloss).

d. Fire Retardant Intumescent Varnish:

MPI 66 (Interior Alkyd Fire Retardant, Clear Top-Coat (UL Approved)) Intumescent Type, Fire Retardant Coating where scheduled: Two (2) coats.

4. Finish for Wood Floors:

a. Hardwood Flooring:

Apply MPI 91 (Wood Filler Paste) to open grained wood. Remove surplus filler and wipe clean.

Sand lightly when dry. Remove dust.

Apply two (2) coats of CID-A-A-2335 (Sealer, Surface).

Apply two (2) thin coats of P-W-155 (Wax Floor, Water Emulsion) and machine buff to uniform luster.

b. Stage Floor: Sand only. No filling, sealing, or waxing is required.

E. Miscellaneous:

1. Apply where specified in Section 09 06 00, SCHEDULE FOR FINISHES.
2. MPI 1 (Aluminum Paint): Two (2) coats of aluminum paint.

3.9 **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 31 (Polyurethane, Moisture Cured, Clear Gloss) 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.

3.10 **PAINT COLOR:**

A. Color and gloss of finish coats is shown on drawings.

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.

3.11

3.12

3.13 **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.

- - - E N D - - -

STUARD & ASSOCIATES, INC
ELEVATOR CONSULTING & INSPECTION

SECTION 14 00 00

Third-Party State Inspections
Equipment Evaluation
Maintenance Performance
Maintenance Specifications
Modernization Analysis
Modernization Specifications
Accident Review

Acceptance Inspections

NAESA
Indiana Certification 10002
Illinois Certification 6010
QEI Certification 5045
IEC

VETERANS AFFAIRS ANN HARBOR HEALTHCARE SYSTEM ELEVATOR ASSESSMENT REPORT

2215 Fuller RD.
Ann Arbor, MI 48105

First issued: 08/14/2025

STUARD & ASSOCIATES INC.

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Executive Summary

Stuard & Associates, Inc. conducted a comprehensive evaluation of the elevator systems serving multiple buildings, including 1E (gearless overhead traction) and Buildings 22 and 28. This assessment was carried out in accordance with industry best practices and applicable regulatory standards, including ASME A17.1 – 2019, NFPA, IBC, and the VA's Elevator Design Manual.

Key Findings:

1. **Aging Equipment & Component Unavailability** – Many essential replacement components for these systems are no longer manufactured or readily available, posing a significant challenge for long-term maintenance and operational reliability.
2. **Safety & Compliance Risks** – Potential asbestos contamination has been identified in hoistway doors, which requires further investigation and proper mitigation to ensure compliance with environmental and safety standards.
3. **Single Bottom Cylinder Risk** – Building 22 may contain a single bottom cylinder, which presents a potential safety hazard due to its risk of failure and non-compliance with modern safety standards. A detailed assessment is recommended to confirm its status and determine necessary corrective actions.
4. **Wear & Aesthetic Degradation** – Interior cab finishes, and operational components exhibit noticeable signs of wear and deterioration, affecting both functionality and the user experience.
5. **Hydraulic System Concerns & Modernization Opportunities** – The hydraulic elevator systems require modernization to improve efficiency, reduce maintenance demands, and align with current industry standards for performance and safety.

Recommendations:

To address these critical issues, we strongly recommend implementing a **comprehensive modernization plan** focused on:

- **Upgrading obsolete components** with readily available, industry-standard alternatives to ensure long-term maintainability.
- **Investigating and mitigating asbestos risks** to comply with environmental health and safety regulations.
- **Replacing or upgrading single bottom cylinders** where necessary to eliminate potential hazards.
- **Enhancing interior finishes and user experience** through refurbishment or replacement of worn cab components.
- **Optimizing hydraulic systems** to improve efficiency, safety, and performance reliability.
- **Exploring the feasibility of replacing a conventional direct acting hydraulic elevator with low-rise hole-less elevator** in suitable locations.

By implementing these improvements, the organization will enhance elevator reliability, safety, and operational efficiency while extending the lifespan of critical vertical transportation infrastructure.

Methodology

The assessment utilized non-destructive visual inspections to evaluate the condition of the elevators. While this method is effective for initial evaluations, it has limitations, particularly in detecting issues that are not visible or accessible. Assumptions about underlying conditions were made based on observed indicators and standard industry practices. The evaluation referenced multiple industry standards and guidelines, including the U.S. Department of Veterans Affairs PG 18-10, ASME 17.1 – 2019, and various NFPA codes. These references provided a benchmark for assessing the performance, safety, and compliance of the elevator systems.

Historical Overview

The VA Ann Arbor Healthcare System (VAAAHS) has been serving veterans since 1953, providing state-of-the-art, evidence-based, and veteran-centered healthcare services to those residing in southeastern Michigan and northwestern Ohio. Over the decades, VAAAHS has expanded its facilities, services, and research capabilities to meet the growing needs of veterans.

In 2012, VAAAHS enhanced its research capacity by leasing space at the University of Michigan's North Campus Research Complex. This move facilitated collaboration between VAAAHS's Center for Clinical Management Research and the university's Institute for Healthcare Policy and Innovation, enabling advancements in areas such as patient safety and opioid addiction treatment.

Significant expansions took place in 2013 with the opening of a new wing and emergency department, followed by additional clinical space in 2018. These upgrades were crucial as the number of veterans seeking care increased to nearly 80,000 individuals. In June 2021, the medical center was renamed the Lieutenant Colonel Charles S. Kettles VA Medical Center in honor of the Ypsilanti native and Army veteran who received the Medal of Honor for his heroism during the Vietnam War.

The facility includes 106 acute care beds across various services and a 40-bed community living center. It maintains strong affiliations with the University of Michigan and the University of Toledo College of Medicine, contributing to its status as a teaching hospital that trains over 1,400 healthcare professionals annually.

Throughout its history, VAAAHS has demonstrated both resilience and adaptability in maintaining and upgrading its infrastructure. While some components have been replaced due to damage from flooding or mechanical failures, other systems have been entirely overhauled due to the obsolescence of original equipment. This history underscores the durability of the initial construction but also highlights the challenges associated with maintaining and upgrading aging technology.

Many of the facility's elevators incorporate early versions of solid-state technology, which, while cutting-edge at the time of installation, has now reached the end of its technological lifecycle. As a result, finding replacement parts for these obsolete components has become increasingly difficult, leading to potential extended downtimes during necessary repairs. This situation poses a risk to continuous operation and requires a strategic approach to ensure minimal disruption to hospital services.

A significant concern is the presence of original hoistway doors installed prior to 1971. These doors may contain asbestos, a material commonly used in fire-resistant building materials before its health risks were

fully understood. The potential presence of asbestos presents serious health and safety risks, necessitating immediate action to replace these doors with modern, asbestos-free alternatives. The new doors should be equipped with stainless-steel skins to enhance their durability and maintain a high standard of aesthetics.

Wear and tear on elevator interiors—including flooring, door frames, and wall finishes—has become evident. While these issues may seem primarily aesthetic, they impact the overall safety and user experience of the elevators. Maintaining or refurbishing these elements is important for ensuring a safe and pleasant environment for users, reflecting the facility's commitment to quality and user well-being.

Furthermore, some elevator systems do not conform to current VA standard guidelines. Addressing these compliance gaps is essential to align the systems with contemporary safety and performance requirements, ensuring they meet the highest standards of operation and safety.

Through ongoing modernization efforts, VAAAHS continues to balance its rich history with the need for technological advancements, ensuring that veterans receive the highest level of care in a safe and efficient environment.

Conclusion

The findings of this assessment underscore the urgent need for modernization efforts to maintain the safety, reliability, and efficiency of the elevator systems at the VA Ann Arbor Healthcare System. Aging equipment, outdated components, and potential safety hazards present significant challenges that require immediate attention. The presence of asbestos, the risk associated with single bottom cylinders, and compliance gaps with current safety standards further highlight the necessity of proactive upgrades.

By implementing a comprehensive modernization strategy—ranging from component replacements and asbestos mitigation to hydraulic system improvements the organization will ensure enhanced operational efficiency, safety, and longevity of its vertical transportation infrastructure. These upgrades will not only align the facility with contemporary industry standards but also improve the experience of veterans, staff, and visitors.

As VAAAHS continues its mission of providing high-quality healthcare services, maintaining and upgrading critical infrastructure must remain a priority. Through careful planning, adherence to regulatory standards, and a commitment to continuous improvement, the facility can uphold its legacy of excellence while adapting to the evolving needs of the veteran community.

DEFINITIONS

AHJ: Authority Having Jurisdiction.

COP: Car Operating Panel

CDI: Car Direction Indicator

PI: Position Indicator

R: Replacement

NA: Not Applicable

MCP: Maintenance Control Program is a document required by A17.1 – 2019

VA: Veterans Administration

RH: Right Hand

LH: Left Hand

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RECOMMENDATIONS FOR ENHANCED RELIABILITY

To guarantee optimal performance, long-term durability, and ease of maintenance for your elevator systems, we will highlight below the replacement of specific components with industry-standard, non-proprietary equipment, which will closely adhere to all relative codes and VA Standards for Elevators. This approach not only streamlines the project bidding process by enabling direct comparisons but also guarantees the elevator's long-term serviceability, even in situations where the awarded elevator contractor may not retain future service agreements.

By opting for industry-standard, non-proprietary components, you are making a strategic choice that promotes transparency, cost-effectiveness, and accessibility for maintenance and repairs, as well as follows the VA guidelines for elevators. This decision offers several key advantages:

Competitive Bidding: Utilizing non-proprietary equipment allows for competitive bidding among elevator contractors. This competitive environment can result in more favorable pricing and ensures that the selected components are readily available from multiple suppliers.

Reduced Dependency: Non-proprietary components reduce dependency on a single manufacturer or service provider. In the event of future maintenance or service needs, you are not locked into exclusive agreements, giving you the flexibility to choose from a broader pool of service providers.

Standardization: Industry-standard components adhere to widely recognized specifications and design principles. This standardization simplifies troubleshooting, maintenance, and upgrades since technicians are more likely to be familiar with these components.

Availability: Non-proprietary components are more likely to remain available in the market, even as technology advances. This ensures that replacement parts are accessible when needed, reducing downtime and service disruptions.

Serviceability: The use of non-proprietary components promotes ease of service and maintenance. Technicians can readily access technical documentation and training resources, resulting in more efficient and cost-effective servicing.

In summary, adopting industry-standard, non-proprietary equipment for your elevator system is a highly strategic and forward-looking decision. This approach aligns with the best practices in the elevator industry and adheres to the Veterans Affairs (VA) standards for elevators. By choosing non-proprietary equipment, you promote fair competition among vendors, which can lead to more competitive pricing and better service options. Additionally, industry-standard equipment ensures greater accessibility to replacement parts and support services, which is crucial for the long-term serviceability of the system.

To provide further context, the chart below highlights specific components marked with an “R,” which we recommend replacing as part of any future alteration projects. These components are either outdated or nearing the end of their effective service life. Replacing them is essential for several reasons:

Extended Lifespan: Upgrading these components will significantly enhance the overall durability and longevity of the elevator system. Newer, industry-standard parts will be more resilient and less prone to breakdowns, ensuring that the elevators operate smoothly and reliably over an extended period.

Compliance with VA Standards: The proposed replacements will help align the elevator system with the latest VA standards. These standards may encompass various aspects, such as safety features, accessibility requirements, and energy efficiency. Ensuring compliance with these standards not only meets regulatory requirements but also enhances the safety and usability of the elevators for all users.

Operational Efficiency: New components typically offer improved performance and efficiency. By integrating modern, non-proprietary equipment, the elevators will benefit from advancements in technology that can reduce energy consumption, minimize maintenance needs, and improve overall operational effectiveness.

Investment Protection: Upgrading to non-proprietary, industry-standard equipment protects your investment by future-proofing the elevator system. It ensures that the system remains compatible with a wide range of service providers and parts suppliers, which can help mitigate the risks of obsolescence and maintain the system's value over time.

By implementing these recommended replacements, you will not only address immediate needs but also enhance the long-term functionality and compliance of your elevator system. This approach underscores a commitment to quality, safety, and operational excellence, ultimately benefiting all stakeholders involved.

CODES AND STANDARDS

To ensure a smooth elevator alteration process, several code-related upgrades are essential in various areas, including the machine room, pits, and elevator recall system. These upgrades will adhere to all codes, regulations and VA standards. Below is a break down the requirements for each area:

Elevator: ASME A17.1 -2019
Electrical: NFPA 13, 70, 72, 101, 252 2023
Mechanical: IMC 2021
Existing Building: IEBC 2021
Plumbing: IPC 2021
Fire Code: IFC 2021
Life Safety: NFPA 101 2021
Veterans Administration: PG 18-10 Elevator Design Manual

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MAINTENANCE RESPONSIBILTY

Upon completion of the recommended equipment setup, we advise incorporating the following maintenance schedule and procedures be incorporated into the “Service to be Performed” section of the warranty period.

- The Contractor shall keep the elevator maintained to operate at the original contract speed, keeping the original performance times, including acceleration and retardation as designed and installed by the manufacturer. The door operation shall be adjusted as required to maintain the original door opening and door closing times, within legal limits.
- The Owner reserves the right to make inspections and tests as and when deemed advisable. If it is found that the elevator and associated equipment are deficient either electrically or mechanically, the Contractor will be notified of these deficiencies in writing, and it shall be his responsibility to make corrections within 30 days after his receipt of such notice. In the event that the deficiencies have not been corrected within 30 days, the Owner may terminate the contract and employ a Contractor to make the corrections at the original bidder's expense.
- Approximately six months prior to the end of the contract term, the Owner will make a through maintenance inspection of all elevators covered under the contract. At the conclusion of this inspection, the Owner shall give the Contractor written notice of any deficiencies found. The Contractor shall be responsible for correction of these deficiencies within 10 days after receipt of such notice.

Spare Parts

The Contractor shall provide a list of items. The items shall become the Owner’s property. A list of vendors for all parts used in the installation.

- Maintenance Control Program (MCP): Provide MCP specifically designed for the equipment included under this contract. Include any unique or product specific procedures or methods required to inspect or test the equipment. In addition, identify weekly, bi-weekly, monthly, quarterly, and annual maintenance procedures, including statutory and other required equipment tests. MCP shall meet the requirements of ASME A17.1-2016 Generic types of MCP's are not acceptable. MCP shall be reviewed and approved by the Owner.

REPLACEMENT PARTS AND TECHNICAL SUPPORT

Elevator component manufacturers and elevator contractor shall make available to the Owner or their representative all parts and technical support required to service and maintain the equipment installed.

Elevator manufacturers and elevator contractor shall not have established company policies which would prevent the Owner or their representative from obtaining service parts on a timely basis.
In no event shall the elevator contractor or elevator manufacturer charge prices for service parts to the Owner or their representative that are more than that charged to any other customer of the elevator component manufacturers or contractor, for the same or substantially similar goods in similar quantities.

The elevator contractor or elevator manufacturer shall maintain availability of service parts to the Owner or their representative for a period which matches that of the reasonable life of the elevator equipment.

Provide elevator components from manufacturers that provide online and live telephone elevator technical support to any and all elevator installation, service, and maintenance contractors. Provide elevator components from manufacturers that guarantee accessibility to all replacement and repair parts and components to any and all elevator installation, service, and maintenance contractors. Elevator component manufacturers shall provide published price lists for all elevator parts and components.

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. Product support on-site or by phone and factory training shall be available to any subsequent maintenance contractor chosen by the Owner.

Elevator Microprocessor Human Interface: The interface system must provide complete elevator controller interface capability and must include the elevator controller manufacturer's comprehensive package of installation and diagnostic software. The microprocessor interface system must provide unrestricted access to all West Point meters, all levels of adjustment, and all flags necessary for installation, adjustment, maintenance, and troubleshooting of each elevator and for the elevator group. All software programming must be stored in non-volatile memory. The elevator controller fault log must provide non-volatile memory fault log storage of all faults, trouble calls, and fault history for a minimum of one year and the ability to download or print the fault log. The controller interface must also provide the capability to display and diagnose trouble calls, faults, and shutdowns. Expiring software, degrading operation, and "key" access controls are not acceptable.

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BUILDING 1E INTRODUCTION

Building 1 is equipped with a variety of elevators designed to accommodate different operational needs. Over the years, most of these elevators have undergone upgrades to improve performance, reliability, and safety. However, a few elevators, particularly Service Elevators 1 through 4**,** still rely on older technology and have not yet been modernized.

Currently, Service Elevator 4 is non-operational and is not included in the scope of this project. Based on our understanding, the VA has received approval to upgrade this elevator through a special procurement process, separate from our ongoing modernization efforts. Given this, it is critical to ensure that the upgrade for Service Elevator 3**,** which **is** included in our project, aligns with the equipment selected for Service Elevator 4.

Since Service Elevators 3 and 4 operate as a duplex system**,** they are designed to function in tandem, sharing control and operational logic for efficiency and redundancy. To maintain compatibility and seamless integration, Service Elevator 3 must utilize the same manufacturer, technology, and system components as the VA-approved upgrade for Elevator 4. Ensuring this compatibility is essential to preserving the intended duplex operation, preventing system conflicts, and maintaining reliability for future operations.

By adhering to this approach, we will help ensure a cohesive and fully functional elevator system within Building 1 while minimizing potential performance discrepancies between the two interconnected elevators.

Service Elevators 1,2&3: High-speed, gearless traction elevator specifically for service purposes.

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Attributes of Current Service Elevators 1 & 2

1.	Elevators:	S1&2
2.	Installation Year:	1996
3.	Installing Company:	Unknown
4.	Capacity:	6000#
5.	Speed:	500fpm
6.	Stops:	B,1,3,5&7
7.	Openings:	5
8.	Operation:	Duplex Operation
9.	Controller Type:	Mid-American Elevator Equipment
10.	Drive Model:	Magnetek DSD 412
11.	Machine Location:	Overhead
12.	Machine Type:	Hollister Whitney
13.	DC Motor	
	HP:	64.2
	Voltage:	304
	Amps:	177
	RPM:	127
14.	Cables:	5-9/16” Double Wrapped
15.	Door Frame Type:	Stainless Steel
16.	Door Operation:	
	Elevators S3:	RH 2 Speed Side Sliding
	Elevators S2:	LH 2 Speed Side Sliding
17.	Door Size:	W60” x H84”
18.	Door Panel Type:	Baked Enamel
19.	Door Equipment:	GAL
20.	Door Protection:	Light Ray
21.	Guides:	Roller Guides
22.	Buffers:	Oil
23.	Hall Button Stations:	Flush Mounted
24.	Hall Position Indicator:	First Floor Only
25.	Hall Lanterns:	All Floors
26.	Car Enclosure Condition:	W74” x D107.5” x H96”
27.	Auxiliary Car Operating Panel:	Yes
28.	Car weight:	7000#
29.	Key Operated Hoistway Access:	Yes
30.	Code Blue:	Yes
31.	Phase 1&2 Key Switch:	Yes- 1st floor
32.	Hoistway Service Lighting:	Yes

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Attributes of Current Service Elevator 3

1.	Elevator:	S3
2.	Installation Year:	1996
3.	Installing Company:	Unknown
4.	Capacity:	6000#
5.	Speed:	500fpm
6.	Stops:	B,B1,1-8
7.	Openings:	10
8.	Operation:	Duplex Operation
9.	Controller Type:	Mid-American Elevator Equipment
10.	Drive Model:	Magnetek DSD 412
11.	Machine Location:	Overhead
12.	Machine Type:	Hollister Whitney
13.	DC Motor	
	HP:	64.2
	Voltage:	304
	Amps:	177
	RPM:	127
14.	Cables:	5-9/16” Double Wrapped
15.	Door Frame Type:	Stainless Steel
16.	Door Operation:	
	Elevators S3:	LH 2 Speed Side Sliding
17.	Door Size:	W60” x H84”
18.	Door Panel Type:	Baked Enamel
19.	Door Equipment:	GAL
20.	Door Protection:	Light Ray
21.	Guides:	Roller Guides
22.	Buffers:	Oil
23.	Hall Button Stations:	Flush Mounted
24.	Hall Position Indicator:	First Floor Only
25.	Hall Lanterns:	All Floors
26.	Car Enclosure Condition:	W72.5” x D118” x H96”
27.	Auxiliary Car Operating Panel:	Yes
28.	Car weight:	7000#
29.	Key Operated Hoistway Access:	Yes
30.	Code Blue:	Yes
31.	Phase 1&2 Key Switch:	Yes- 1st floor
32.	Hoistway Service Lighting:	Yes

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EQUIPMENT REPLACMENT ASSESSMENT

DATE OF Assessment
02-03-2025

Department of Veterans affairs
Ann Arbor, Health Care
2215 Fuller Rd.
Ann Arbor, MI 48105

Building Number	No. of stops	No. of Openings
1E-Service Elevators	**5**	**5**

Manufacturer/Year Installed – American Elevator/Hollister Whitney	Rated Capacity – **6000#**	
Elevator numbers – S1 & S2	Rated Speed (fpm) – **500fpm**	Code Year – **1996**

CONDITION OF EQUIPMENT

MACHINE ROOM	*OK*	**R**	**NA**				
HOLLISTER GEARLESS MACHINE		R					Replacement parts no longer available.
HOIST CABLES		R					Replace with new machines.
CONTROLLER		R					Out of date technology.
DRIVE UNIT		R					Part no longer available.
DEFLECTOR SHEAVES		R					Original. Should be changed.
GOVENORS		R					Original. Should be changed.
HOISTWAY							
HOISTWAY DOOR EQUIPMENT	OK						Replacement parts are available. Replace on a as needed basis. Include in the project warranty.
DOOR PANELS		R					Does not meet VA Standards for Stainless Steel.
ENTRANCE FRAMES	OK						
SILLS	OK						
MAIN GUIDE RAILS AND SUPPORTS	OK						
LIMIT SWITCHES/POSITIONING SYSTEM		R					Will be replaced with new controller.
TRAVELING CABLES/WIRING		R					Will be replaced with new controller.
ELEVATOR CARTOP							
CAR SLING AND PLATFORM	OK						
ROLLER GUIDES	OK						Replacement rollers still available.
CAR DOOR EQUIPMENT		R					
HANDRAIL		R					Add fall hazard protection around cartop.
TOP CAR OPERATING DEVICE	OK						
EMERGENCY EXIT CONTACT	OK						
LIGHTING	OK						
PIT							
PIT LADDER	OK						
PIT STOP SWITCH	OK						

BUFFERS	OK						
PIT CHANNELS (STEEL)	OK						
LIGHTING	OK						
LOBBIES							
HALL PUSH BUTTONS		R					Will change with new controllers. We will also add additional buttons to elevators 5-8 side of the hall, where none are present.
HALL POSITION/LANTERNS		R					Will be changed with new controllers.
LOBBY PANEL			NA				
HOISTWAY ACCESS KEY SWITCH	OK						
FIRE SERVICE KEY SWITCH		R					Will be changed with new hall fixture. Will also remain on the first floor
ADA REQUIREMENTS	OK						
ELEVATOR INTERIOR							
CAR ENCLOSURE		R					Cab interiors for a fresh look
CAR CANOPY		R					
CAR FLOORING		R					Suggest replacement with new cab.
CAR LIGHTING		R					
CAR VENTILATIONS		R					
CAR OPERATING PANEL - Main		R					Will need to be replaced with new controller.
CAR OPERATING PANEL – Auxiliary		R					Will need to be replaced with new controller.
CAR COMMUNICATION		R					Will need to add an in-car camera function to satisfy the new A17.1 code addition.

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EQUIPMENT REPLACMENT ASSESSMENT

DATE OF Assessment
02-03-2025

Department of Veterans affairs
Ann Arbor, Health Care
2215 Fuller Rd.
Ann Arbor, MI 48105

Building Number	No. of stops	No. of Openings
1E-Service Elevators	**10**	**10**

Manufacturer/Year Installed – American Elevator/Hollister Whitney	Rated Capacity – **6000#**	
Elevator numbers – S3	Rated Speed (fpm) – **500fpm**	Code Year – **1996**

CONDITION OF EQUIPMENT

MACHINE ROOM	*OK*	**R**	**NA**				
HOLLISTER GEARLESS MACHINE		R					Replacement parts no longer available.
HOIST CABLES		R					Replace with new machines.
CONTROLLER		R					Out of date technology.
DRIVE UNIT		R					Part no longer available.
DEFLECTOR SHEAVES		R					Original. Should be changed.
GOVENORS		R					Original. Should be changed.
HOISTWAY							
HOISTWAY DOOR EQUIPMENT	OK						Replacement parts are available. Replace on a as needed basis. Include in the project warranty.
DOOR PANELS		R					Does not meet VA Standards for Stainless Steel.
ENTRANCE FRAMES	OK						
SILLS	OK						
MAIN GUIDE RAILS AND SUPPORTS	OK						
LIMIT SWITCHES/POSITIONING SYSTEM		R					Will be replaced with new controller.
TRAVELING CABLES/WIRING		R					Will be replaced with new controller.
ELEVATOR CARTOP							
CAR SLING AND PLATFORM	OK						
ROLLER GUIDES	OK						Replacement rollers still available.
CAR DOOR EQUIPMENT		R					
HANDRAIL		R					Add fall hazard protection around cartop.
TOP CAR OPERATING DEVICE	OK						
EMERGENCY EXIT CONTACT	OK						
LIGHTING	OK						
PIT							
PIT LADDER	OK						
PIT STOP SWITCH	OK						

BUFFERS	OK						
PIT CHANNELS (STEEL)	OK						
LIGHTING	OK						
LOBBIES							
HALL PUSH BUTTONS		R					Will change with new controllers. We will also add additional buttons to elevators 5-8 side of the hall, where none are present.
HALL POSITION/LANTERNS		R					Will be changed with new controllers.
LOBBY PANEL			NA				
HOISTWAY ACCESS KEY SWITCH	OK						
FIRE SERVICE KEY SWITCH		R					Will be changed with new hall fixture. Will also remain on the first floor
ADA REQUIREMENTS	OK						
ELEVATOR INTERIOR							
CAR ENCLOSURE		R					Cab interiors for a fresh look
CAR CANOPY		R					
CAR FLOORING		R					Suggest replacement with new cab.
CAR LIGHTING		R					
CAR VENTILATIONS		R					
CAR OPERATING PANEL - Main		R					Will need to be replaced with new controller.
CAR OPERATING PANEL – Auxiliary		R					Will need to be replaced with new controller.
CAR COMMUNICATION		R					Will need to add an in-car camera function to satisfy the new A17.1 code addition.

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CODE ENHANCMENTS

Machine Room:

- Illumination: Ensure a minimum of 200 lux of lighting across the machine room floor.
- GFCI Outlet: Include a Ground Fault Circuit Interrupter (GFCI) outlet within the machine room. This outlet must be fed from a dedicated source according to the current NEC requirements.
- Ambient Conditions: Ensure that the exhaust fan and heater are compatible to maintain an ambient air temperature between 50 and 90-degrees Fahrenheit with no more than 95% humidity.
- Per NFPA standards there shall be a heat detector within 2' feet of each sprinkler head.

Pits:

- Lighting: Increase pit lighting to a minimum of 100 lux.
- GFCI Outlet: Install a GFCI outlet on a dedicated circuit in the pit.
- Sump Pump: Although a sump pump is not required to be installed under the alteration section of the elevator code, new elevators are required by code to have sump pumps in accordance with A17.1-2022/2.2.2.5. It should have a minimum evacuation capacity of 3000 gallons per hour (gph). We would suggest at the minimum a surface mounted sump pump be added to the pit area to evacuate any water introduced by a fire emergency.
- Dedicated Plug: If a sump pump is added a single dedicated plug for the sump pump must be added.

Elevator Recall:

- With the elevator alteration fire recall will need to be added to comply with current code. This system will consist of three relays that will control the primary and secondary recall applications of recall along with the third relay controlling the flashing hat function. All fire initiation devices within the elevator recall system must be of the addressable type.

VA Design Guide Requirements:

Even though it is not possible to change the function of the current door systems from side sliding to center opening on the passenger elevators we can still adhere to the stainless-steel requirements as set forth in:

Section 5: **DOORS AND FRAMES**

Entrances for Passenger, Service and Freight Elevators: 1) Hoistway doors must be reinforced, two panel construction, with stainless steel on the outside surface, wrapped around the leading edge.

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BASIS OF DESIGN

Motion Control System Upgrade: Basis of Design – MCE, WWW.acim.nidec.com

Consider upgrading the existing control system with a state-of-the-art microprocessor control system that offers the following key features:

a) Duplex Selective Collective Operation
b) Emergency Power Capability
c) On-Board Diagnostics Panel
d) Control Landing System
e) Firefighters Service Phase 1 & 2
f) Independent Service Modes
g) Code Blue
h) Hoistway Access Capability
i) Cartop Operation
j) Timed Control of Interior Lighting and Fan Circuitry
k) Pre-transfer Signal for Emergency Power powered by 2 wires from the building switch gear

Traction System Replacement: Basis of Design – Hollister Whitney. WWW.hollisterwhitney.com

Evaluate the possibility of replacing the current traction machines and their associated components with industry-standard alternatives. This comprehensive replacement should encompass:

a) Drive Machine
b) Deflector Sheaves
c) Motors
e) Governors & Ropes
f) Hoist Cables

Hoistway Doors/Door Equipment Upgrade: Basis of Design - GAL. WWW.GAL.Com

Replace all existing elevator system door equipment with top-tier manufacturers of elevator door equipment, such as GAL. This includes:

a) Hall Door Equipment (As Needed)
b) Car Door Operators
c) Car Door Equipment
d) Hoistway Doors

Hall & Car Fixtures: Basis of Design – Innovation. WWW.Innovation.com

With the change of the motion controller the following will also need to be replaced:

a) Hall pushbuttons
b) Main Car Operating Panel
c) Auxiliary Car Operating Panel
d) Combination Hall Direction Indicators & Car Position Indicators

e) Emergency Power Jewel, powered by 2 wires from the building switch gear to the motion controller

Additional Equipment to Upgrade: No Basis of Design Needed

Consider implementing the following elevator alterations for improved functionality and aesthetics:
a) Upgrade Elevator Cartop Equipment
b) Replace Hall/Elevator Control Fixtures
c) Install Cartop Handrails
d) Install New Hoistway Doors with Stainless Steel Skins
e) All New Wiring

Project Timeline

The project dates below are estimates from the Notice to Proceed date awarded to the Elevator Contractor.

1. Elevator engineering drawings and submittal review and approval.
    - 4 to 6 weeks.

2. Ordered material lead times. **Note:** The Elevator Industry much like other industries has been experiencing supply chain shortages which has led to longer than normal lead times with some material.
    - 14 to 16 weeks.

3. After material has been delivered to the project site, time to complete project.
    - S1 Elevator - 14 to 16 weeks.
    - S2 Elevator - 14 to 16 weeks.
    - S3 Elevator - 18 to 20 weeks.

4. After each elevator has been completed by the Elevator Contractor an A17.1 -2022 mandated Acceptance Test must be performed by a licensed Third-Party Qualified Elevator Inspector (QEI). Stuard & Associates has been retained by West Point Engineers and Constructors to perform this test. Each test should only take a day to complete if elevator and code items have been completed.

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Building 22 Introduction

The service elevator in Building 22 plays a critical role in the ongoing renovation efforts, currently serving as the primary means for transporting both personnel and materials to the upper floors. This elevator operates on a hydraulic system supplied by the Minnesota Elevator Company and is controlled by a 1998 MCE motion controller, which was installed during the last recorded alteration. Despite various upgrades over time, key components of the system remain outdated, presenting both operational and safety concerns.

One of the most significant risks associated with this elevator system is the condition of the plunger cylinder. The cylinder was not replaced during the last alteration, meaning that its original installation date pre-dates current safety codes. Given its age, there is a strong likelihood that it is a **single-bottom cylinder**, which is now prohibited under modern regulations due to its potential for sudden and catastrophic failure. Single-bottom cylinders are particularly susceptible to corrosion and pressure-related failures, which could result in severe safety hazards for both passengers and property.

Code Compliance & Safety Concerns

Under the latest safety standards set forth by ASME A17.1, single-bottom cylinders are no longer permitted due to the inherent risk of failure. Many building owners facing this issue have opted to replace their existing cylinders with double-bottom or encapsulated cylinders to meet code compliance and enhance safety. However, replacing a plunger cylinder in a hydraulic system is a costly and labor-intensive process, often requiring excavation around the pit area and the use of specialized equipment to remove the old assembly and install a new one.

Given the significant costs associated with cylinder replacement, an alternative solution worth considering is a complete removal of the existing hydraulic elevator system in favor of a Hole-less twin post hydraulic elevator**.** This type of system offers numerous advantages, including:

- **Reduced structural risk** – A hole-less configuration eliminates the need for an in-ground cylinder, removing concerns related to corrosion, groundwater intrusion, and long-term environmental liability.
- **Improved reliability** – Twin post hydraulic systems avoid many common single-cylinder failure modes and significantly reduce the risk of catastrophic cylinder failure, oil leakage, and undetected underground deterioration.
- **Code compliance and longevity** – Installation of a new hole-less hydraulic system would eliminate the inherent risks associated with the existing single-bottom cylinder and provide full compliance with current elevator codes, supporting long-term operational viability and safety.

Accelerated Wear & System Deterioration

Adding to these concerns, the current renovation efforts are placing extreme strain on an already aging and deteriorating elevator system. Construction personnel are subjecting the elevator to heavy, repeated use**,** often exceeding typical operational loads and duty cycles. This increased demand is accelerating component wear, particularly in areas such as the hydraulic pump, valve system, guide rails, and door operators. Over time, this excessive strain can lead to frequent service interruptions, increased maintenance costs, and an overall decline in operational safety.

Given the combination of outdated components, safety risks, high maintenance costs, and ongoing excessive wear**,** a comprehensive modernization or full replacement of the system should be seriously considered. Investing in a Hole-less hydraulic elevator would not only provide a safer and more efficient solution but would also ensure compliance with modern safety standards while reducing long-term maintenance and energy expenses.

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Attributes of Current Service Elevator – Building 22

1.	Elevator:	S1
2.	Installation Year Code:	1971
3.	Capacity:	4000#
4.	Speed:	100fpm
5.	Stops:	2
6.	Openings:	G&1
7.	Operation:	Simplex Operation
8.	Door Operation:	RH Two Speed Side Sliding
9.	Door Size:	W48" x H84"
10.	Door Panel Type:	Baked Enamel
11.	Door Equipment:	Schindler
12.	Door Protection:	Safe Edge
13.	Guide Rails:	T-15#
14.	Guide Shoes:	Slide Guides
15.	Buffers:	Spring
16.	Hydraulic Reservoir:	Submersible/MEI
17.	Controller:	MCE
18.	Control Valve:	Maxton
19.	Motor:	30HP,200V,76A,3440RPM
20.	Hall Button Stations:	Flush Mounted
21.	Hall Lanterns:	No
22.	Hall PI:	No
23.	Handicap Requirements:	Yes
24.	Wiring:	Yes
25.	Car Enclosure:	W-64.25"xD92"xH96"
26.	Car weight:	3425#
27.	Exhaust Fan:	Yes
28.	Hoistway Entrances:	Stainless Steel
29.	Key Operated Hoistway Access:	Yes
30.	Security:	None
31.	Phase 1&2 Key Switch:	No
32.	Position Indicator:	None
33.	Auxiliary C.O.P.:	No
34.	Service Lighting:	No

Conclusion & Recommendation

Based on the current condition of the service elevator in Building 22, it is strongly recommended that the existing hydraulic elevator system be completely removed and replaced with a modern hole-less hydraulic elevator system. The elevator's outdated components—including the 1998 MCE motion controller, the aging hydraulic equipment, and the likely non-compliant single-bottom plunger cylinder—present elevated safety risks, increasing maintenance challenges, and long-term operational concerns. Given these conditions, full system replacement represents the most practical, cost-effective, and sustainable long-term solution.

As part of the removal of the existing hydraulic system, it is recommended that the in-ground piston be extracted where feasible, hydraulic oil properly drained and disposed of in accordance with environmental regulations, and the cylinder bore permanently abandoned. The abandoned cylinder hole should be filled to the top with bagged pre-mixed concrete and either capped with additional concrete or covered and anchored with a steel plate to ensure long-term safety, environmental protection, and code compliance.

A hole-less hydraulic elevator system is recommended as the basis of design due to its proven reliability, reduced structural risk, and compliance with current elevator safety codes. Unlike traditional in-ground hydraulic elevators, a hole-less configuration eliminates the risks associated with buried cylinders, including corrosion, groundwater contamination, and undetected cylinder deterioration. This system provides dependable performance while retaining the simplicity and serviceability of hydraulic operation, making it well suited for a service elevator application.

One of the key advantages of a hole-less hydraulic system is its ability to be installed within the existing hoistway, pit, and overhead dimensions, minimizing the need for costly structural modifications. This approach allows the building to achieve full code compliance and improved operational reliability while controlling overall project cost and construction complexity.

As part of this modernization effort, it is also recommended that all existing hall doors and entrance frames be removed and replaced with new assemblies. This ensures proper integration with the new elevator equipment, reduces future maintenance requirements, and enhances passenger safety and security. New entrance assemblies will also improve the visual appearance and structural integrity of the elevator openings, further supporting the overall modernization of the building's vertical transportation system.

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Building 28 Introduction

Building 28 is equipped with three hydraulic elevators: C1, C2, and C3. These elevators were originally installed by ESCO in the late 1980s and underwent a control system upgrade in 1997 with an early version of microprocessor controls supplied by Motion Control Engineering (MCE). However, this system is now considered obsolete, making future maintenance and part replacement increasingly challenging.

Elevator Configuration and Usage

- **C1 and C2:** These passenger elevators operate from a shared machine room and serve as the primary means of vertical transportation for building occupants.
- **C3 (Service Elevator):** This elevator is designated for building staff and service-related functions. It has a separate machine room, ensuring its operation does not interfere with passenger service.

The hoistway frames for all three elevators are constructed of stainless steel, offering durability and resistance to corrosion. However, the hoistway doors are baked enamel, which does not currently meet VA standards. Upgrading these doors should be considered to ensure compliance with modern regulations.

Additionally, the interior aesthetics of the elevator cabs have started to show noticeable wear due to decades of continuous use. Aesthetic improvements, such as new interior paneling, flooring, and lighting, should be considered to enhance the overall appearance and user experience while aligning with contemporary design standards.

With the aging control system, non-compliant door materials, and visible wear on the cab interiors, modernization of Building 28's elevators would not only improve functionality and safety but also provide a more visually appealing and reliable experience for passengers and staff.

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Attributes of Current Passenger Elevators – Building 28

1.	Elevator:	C1 & C2
2.	Installation Year Code:	1988
3.	Alteration:	1997
4.	Capacity:	4000#
5.	Speed:	125/150fpm
6.	Stops:	3
7.	Openings:	G,1&2
8.	Operation:	Duplex Operation
9.	Door Operation:	
	C1:	RH Two Speed Side Sliding
	C2:	LH Two Speed Side Sliding
10.	Door Size:	W48" x H84"
11.	Door Panel Type:	Baked Enamel
12.	Door Equipment:	GAL
13.	Door Protection:	Light Ray
14.	Guide Rails:	T-15#
15.	Guide:	Roller Guides
16.	Buffers:	Spring
17.	Hydraulic Reservoir:	Submersible/MEI
18.	Controller:	MCE
19.	Control Valve:	Maxton
20.	Motor:	40HP,200V,104/52A,3410RPM
21.	Hall Button Stations:	Flush Mounted
22.	Hall Lanterns:	No
23.	Hall PI:	No
24.	Handicap Requirements:	Yes
25.	Wiring:	Yes
26.	Car Enclosure:	W-63"xD92"xH96"
27.	Car weight:	4055#
28.	Exhaust Fan:	Yes
29.	Hoistway Entrances:	Stainless Steel
30.	Key Operated Hoistway Access:	Yes
31.	Security:	In car third floor car call cut out
32.	Phase 1&2 Key Switch:	No
33.	Position Indicator:	None
34.	Auxiliary C.O.P.:	No
35.	Service Lighting:	No

EQUIPMENT REPLACMENT ASSESSMENT

DATE OF INSPECTION
02-03-2025

Department of Veterans affairs
Ann Arbor, Health Care
2215 Fuller Rd.
Ann Arbor, MI 48105

Building Number	No. of stops	No. of Openings
28	**3**	**3**

Manufacturer/Year Installed – **Esco 1988**	Rated Capacity – **4000#**	
Elevator number – C1 & C2	Rated Speed (fpm) – **125/150fpm**	Code Year – 1997

CONDITION OF EQUIPMENT *(Check)*

MACHINE ROOM	*OK*	**R**	**NA**				
HYDRAULIC RESERVOIR	OK						
CONTROLLER (MCE)		R					
CONTROL VALVE	OK						
MOTOR	OK						
PUMP	OK						
HOISTWAY							
HOISTWAY DOOR EQUIPMENT	OK						
DOOR PANELS		R					Do not adhere to VA Standards
ENTRANCE FRAMES	OK						
SILLS	OK						
MAIN GUIDE RAILS AND SUPPORTS	OK						
LIMIT SWITCHES/POSITIONING SYSTEM		R					
TRAVELING CABLES/WIRING		R					
ELEVATOR CARTOP							
CAR SLING AND PLATFORM	OK						
GUIDES	OK						
CAR DOORS		R					
CAR DOOR EQUIPMENT		R					
HANDRAIL		R					Add during alteration.
TOP CAR OPERATING DEVICE		R					
EMERGENCY EXIT CONTACT	OK						

LIGHTING		R					Service lighting needs to be added.
PIT							
PIT LADDER	OK						
PIT STOP SWITCH		R					
BUFFERS	OK						
SEISMIC RUPTURE VALVE			NA				
PIT CHANNELS (STEEL)	OK						
OIL LINE AND FITTINGS	OK						
LIGHTING		R					Needs upgraded to 10fc
LOBBIES							
HALL PUSH BUTTONS		R					
HALL POSITION/LANTERNS		R					Add in new hall button fixtures and cab return.
LOBBY PANEL			NA				
HOISTWAY ACCESS KEY SWITCH		R					Add with alteration.
FIRE SERVICE KEY SWITCH		R					
ADA REQUIREMENTS	OK						
ELEVATOR INTERIOR							
CAR ENCLOSURE		R					
CAR CANOPY		R					
CAR FLOORING		R					
CAR LIGHTING		R					
CAR VENTILATIONS		R					
CAR OPERATING PANEL - Main		R					
CAR OPERATING PANEL – Auxiliary		R					Add with alteration.
CAR COMMUNICATION		R					

Attributes of Current Passenger Elevators – Building 28

1.	Elevator:	C3
2.	Installation Year Code:	1988
3.	Alteration:	1997
4.	Capacity:	5000#
5.	Speed:	125/150fpm
6.	Stops:	3
7.	Openings:	G,1&2
8.	Operation:	Simplex Operation
9.	Door Operation:	
	Front:	LH Two Speed Side Sliding
	Rear:	RH Two Speed Side Sliding
10.	Door Size:	W48" x H84"
11.	Door Panel Type:	Baked Enamel
12.	Door Equipment:	GAL
13.	Door Protection:	Light Ray
14.	Guide Rails:	T-15#
15.	Guide:	Roller Guides
16.	Buffers:	Spring
17.	Hydraulic Reservoir:	Submersible/MEI
18.	Controller:	MCE
19.	Control Valve:	Maxton
20.	Motor:	40HP,200V,104/52A,3410RPM
21.	Hall Button Stations:	Flush Mounted
22.	Hall Lanterns:	No
23.	Hall PI:	No
24.	Handicap Requirements:	Yes
25.	Wiring:	Yes
26.	Car Enclosure:	W-66.5"xD104"xH96"
27.	Car weight:	4630#
28.	Exhaust Fan:	Yes
29.	Hoistway Entrances:	Stainless Steel
30.	Key Operated Hoistway Access:	Yes
31.	Security:	In car third floor car call cut out
32.	Phase 1&2 Key Switch:	No
33.	Position Indicator:	None
34.	Auxiliary C.O.P.:	No
35.	Service Lighting:	No

EQUIPMENT REPLACMENT ASSESSMENT

DATE OF INSPECTION
02-03-2025

Department of Veterans affairs
Ann Arbor, Health Care
2215 Fuller Rd.
Ann Arbor, MI 48105

Building Number	No. of stops	No. of Openings
28	**3**	**3**

Manufacturer/Year Installed – Esco 1988	Rated Capacity – **4000#**	
Elevator number – C3	Rated Speed (fpm) – **125/150fpm**	Code Year – 1997

CONDITION OF EQUIPMENT *(Check)*

MACHINE ROOM	*OK*	**R**	**NA**				
HYDRAULIC RESERVOIR	OK						
CONTROLLER (MCE)		R					
CONTROL VALVE	OK						
MOTOR	OK						
PUMP	OK						
HOISTWAY							
HOISTWAY DOOR EQUIPMENT	OK						
DOOR PANELS		R					Do not adhere to VA Standards
ENTRANCE FRAMES	OK						
SILLS	OK						
MAIN GUIDE RAILS AND SUPPORTS	OK						
LIMIT SWITCHES/POSITIONING SYSTEM		R					
TRAVELING CABLES/WIRING		R					
ELEVATOR CARTOP							
CAR SLING AND PLATFORM	OK						
GUIDES	OK						
CAR DOORS		R					
CAR DOOR EQUIPMENT		R					
HANDRAIL		R					Add during alteration.
TOP CAR OPERATING DEVICE		R					
EMERGENCY EXIT CONTACT	OK						

LIGHTING		R					Service lighting needs to be added.
PIT							
PIT LADDER	OK						
PIT STOP SWITCH		R					
BUFFERS	OK						
SEISMIC RUPTURE VALVE			NA				
PIT CHANNELS (STEEL)	OK						
OIL LINE AND FITTINGS	OK						
LIGHTING		R					Needs upgraded to 10fc
LOBBIES							
HALL PUSH BUTTONS		R					
HALL POSITION/LANTERNS		R					Add in new hall button fixtures and cab return.
LOBBY PANEL			NA				
HOISTWAY ACCESS KEY SWITCH		R					Add with alteration.
FIRE SERVICE KEY SWITCH		R					
ADA REQUIREMENTS	OK						
ELEVATOR INTERIOR							
CAR ENCLOSURE		R					
CAR CANOPY		R					
CAR FLOORING		R					
CAR LIGHTING		R					
CAR VENTILATIONS		R					
CAR OPERATING PANEL - Main		R					
CAR OPERATING PANEL – Auxiliary		R					Add with alteration.
CAR COMMUNICATION		R					

CODE ENHANCMENTS

Machine Room:

- GFCI Outlet: Include a Ground Fault Circuit Interrupter (GFCI) outlet within the machine room. This outlet must be fed from a dedicated source according to the current NEC requirements.

- Ambient Conditions: Ensure that the exhaust fan and heater are compatible to maintain an ambient air temperature between 50 and 90-degrees Fahrenheit with no more than 95% humidity.
- Per NFPA standards there shall be a heat detector within 2' feet of each sprinkler head.

Pits:

- Lighting: Increase pit lighting to a minimum of 100 lux.
- GFCI Outlet: Install a GFCI outlet on a dedicated circuit in the pit.
- Sump Pump: Although a sump pump is not required to be installed under the alteration section of the elevator code, new elevators are required by code to have sump pumps in accordance with A17.1-2022/2.2.2.5. It should have a minimum evacuation capacity of 3000 gallons per hour (gph). We would suggest at the minimum a surface mounted sump pump be added to the pit area to evacuate any water introduced by a fire emergency.
- Dedicated Plug: If a sump pump is added a single dedicated plug for the sump pump must be added.

Hoistway:

- Add hoistway service lighting at each floor within the elevator shaft. Lighting must illuminate to a minimum of 10fc at each level.

Elevator Recall:

- With the elevator alteration fire recall will need to be added to comply with current code. This system will consist of three relays that will control the primary and secondary recall applications of recall along with the third relay controlling the flashing hat function. All fire initiation devices within the elevator recall system must be of the addressable type.

VA Design Guide Requirements:

Even though it is not possible to change the function of the current door systems from side sliding to center opening on the passenger elevators we can still adhere to the stainless-steel requirements as set forth in:

Section 5: **DOORS**

Entrances for Passenger, Service and Freight Elevators: 1) Hoistway doors must be reinforced, two panel construction, with stainless steel on the outside surface, wrapped around the leading edge.

BASIS OF DESIGN

Motion Control System Upgrade: Basis of Design – www.alphaelevatorcontrol.com.

Consider upgrading the existing control system with a state-of-the-art microprocessor control system that offers the following key features:

a) Duplex Selective Collective Operation

b) Emergency Power Capability
c) On-Board Diagnostics Panel
d) Control Landing System
e) Firefighters Service Phase 1 & 2
f) Independent Service Modes
g) Code Blue
h) Hoistway Access Capability
i) Cartop Operation
j) Timed Control of Interior Lighting and Fan Circuitry
k) Pre-transfer Signal for Emergency Power powered by 2 wires from the building switch gear

Hoistway Doors/Door Equipment Upgrade: Basis of Design - GAL. WWW.GAL.Com

Replace all existing elevator system door equipment with top-tier manufacturers of elevator door equipment, such as GAL. This includes:

a) Hall Door Equipment
b) Car Door Operator
c) Car Door Equipment
d) Hoistway Doors

Hall & Car Fixtures: Basis of Design – Innovation. WWW.Innovation.com

With the change of the motion controller the following will also need to be replaced:

a) Hall pushbuttons
b) Main Car Operating Panel
c) Auxiliary Car Operating Panel
d) Combination Hall Direction Indicators & Car Position Indicators

Additional Equipment to Upgrade: No Basis of Design Needed

Consider implementing the following elevator alterations for improved functionality and aesthetics:
a) Upgrade Elevator Cartop Equipment
b) Replace Hall/Elevator Control Fixtures
c) Install New Hoistway Doors with Stainless Steel Skins
d) All New Wiring

Project Timeline

The project dates below are estimates from the Notice to Proceed date awarded to the Elevator Contractor.

5. Elevator engineering drawings and submittal review and approval.
    - 4 to 6 weeks.

6. Ordered material lead times. **Note:** The Elevator Industry much like other industries has been experiencing supply chain shortages which has led to longer than normal lead times with some material.
    - 10 to 12 weeks.

7. After material has been delivered to the project site, time to complete project.
    - C1 Elevator - 5 to 7 weeks
    - C2 Elevator – 5 to 7 weeks
    - C3 Elevator – 5 to 7 weeks

8. After each elevator has been completed by the Elevator Contractor an A17.1 -2022 mandated Acceptance Test must be performed by a licensed Third-Party Qualified Elevator Inspector (QEI). Stuard & Associates has been retained by West Point Engineers and Constructors to perform this test. Each test should only take a day to complete if elevator and code items have been completed.

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Closing Remarks

The comprehensive modernization of the elevator systems across VA Ann Arbor's facilities—including Buildings E1, 3, 22, and 28—represents a critical step in enhancing safety, efficiency, and compliance with Veterans Affairs (VA) standards. Many of the existing elevators rely on outdated, proprietary hydraulic equipment, originally installed decades ago, which has become increasingly difficult to maintain and fails to meet current VA design requirements. These aging systems not only pose operational challenges but also compromise accessibility, reliability, and user experience for VA staff, patients, and visitors.

A full system replacement within these facilities is necessary to align with VA regulations, eliminate reliance on proprietary components, and introduce modern, non-proprietary hydraulic or traction elevator systems. This transition will enhance operational efficiency, improve ease of maintenance, and reduce long-term lifecycle costs. Furthermore, addressing the hoistway deficiencies—such as the lack of stainless steel-skinned interiors—will significantly improve durability and compliance, while upgrading finishes and materials will modernize aesthetics to better reflect the high standards of a VA healthcare environment.

If the project budget remains outside of established limits, it is recommended that Elevator C3 in Building 28 be removed from the scope. Eliminating C3 will in no way hinder the building's accessibility or operational needs, as Elevators C1 and C2—both located in direct proximity to C3—will be upgraded and fully capable of providing reliable service.

Beyond technical improvements, this project underscores the VA's commitment to fostering a safe, functional, and welcoming space. Reliable elevator systems are essential to the seamless operation of medical facilities, ensuring that staff can move efficiently, patients receive timely care, and visitors experience minimal inconvenience. By investing in these essential upgrades, VA Ann Arbor is proactively addressing infrastructure challenges and reinforcing its dedication to maintaining a first-class healthcare environment.

Moving forward with this project will not only resolve current deficiencies but also future-proof VA Ann Arbor's facilities, ensuring compliance, cost-effective maintenance, and long-term reliability. A modernized elevator system will play a key role in supporting the VA's mission to provide accessible, high-quality care and services to veterans, making this investment both necessary and impactful for years to come.

END OF REPORT

SECTION 14 21 10

TRACTION ELEVATOR – MODERNIZATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the engineering, furnishing and installation of the complete electric traction elevator system as described herein and as indicated on the 1E Contract drawings.

B. Items listed in the singular apply to each elevator in this specification except where noted.

ELEVATOR SCHEDULE	
Elevator Numbers	S1, S2, S3
Overall Platform Size	Field Verify
Clear Inside Platform	W72.5”xD118”xH96”
Rated Load – kg (lb)	6000#
Contract Speed - m/s (fpm)	500fpm
Total Travel – m (ft)	Field Verify
Floors Served	B,B1,1-8
Number of Openings	10
Entrance Type & Size	LH 2 Speed Side Sliding W60” x H84”
Type of Roping	1:1

C. Service/Passenger Elevator S3 must be overhead traction, microprocessor control system, AC VVVF motor control, power operated car and hoistway doors. Elevator must be Class “C3” loading rated as a minimum.

1.2 RELATED WORK

A. Section 01 33 23 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.

B. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-rated construction.

C. 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.

D. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL

COMPONENTS: Requirements for seismic restraint of non-structural components.

E. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.

F. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.

G. 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.

H. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.

I. Section 26 22 00, LOW-VOLTAGE TRANSFORMERS: Low voltage transformers.

J. Section 26 24 16, PANELBOARDS: Low voltage panelboards.

K. Section 26 51 00, INTERIOR LIGHTING: Fixture and ballast type for interior lighting.

L. Submittal - 006 - 14 21 00-1 Traction Elevator Submittal Package.

1.3 QUALIFICATIONS

A. Approval by the Contracting Officer is required for products and services of proposed manufacturers, suppliers, installers and must be contingent upon submission of certificates by the Contractor stating the following:

1. Elevator contractor is currently and regularly engaged in the installation of elevator equipment as one of his principal products.
2. Elevator contractor must have five (5) years of successful experience, trained supervisory personnel and facilities to install elevator equipment specified herein.

Elevator Mechanic (Installer) must 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 must be actively pursuing Certified Elevator Mechanic status.

Certification must be submitted for all workers employed in this capacity.

B. Welding at the project site must be performed by certified welders who have previously qualified by test as prescribed in American Welding Society Publications AWS Dl.1 to perform the type of work required. Certificates must be submitted for all workers employed in this

capacity. A welding or hot work permit is required for each day and must be obtained from the VAMC safety department. Request permit one day in advance.

C. Electrical work must be performed by a Licensed Master Electrician and Licensed Journeymen Electricians as requirements by NEC. Certificates must be submitted for all workers employed in this capacity.

D. Approval will not be given to elevator contractors and manufacturers who have established on prior projects, either government, municipal, or commercial, a record of unsatisfactory elevator installations, have failed to complete awarded contracts within the contract period and do not have the requisite record of satisfactory performing elevator installations of similar type and magnitude.

E. Approval of Elevator Contractor’s equipment must be contingent on the equipment manufacturer providing factory training, engineering and technical support, including all manuals, wiring diagrams and tools necessary for adjusting, maintenance, repair and testing of equipment to the VA for use by the VA’s designated Elevator Maintenance Service Provider.

F. Identifying an elevator maintenance service provider that must render services within two hours of receipt of notification, together with certification that the quantity and quality of replacement parts stock is enough to warranty continued operation of the elevator installation.

G. Equipment within a group of traction elevators must be the product of the same manufacturer.

H. The Contractor must 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.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification. Elevator installation must meet the requirements of the latest editions published and adopted by the United States Department of Veterans Affairs on the date contract is signed.

B. Federal Specifications (Fed. Spec.):
J-C-30B - Cable and Wire, Electrical (Power, Fixed Installation)
J-C-580 – Cord, Flexible and Wire, Fixture
W-S-610 – Splice Connectors

W-C-596F - Connector, Plug, Electrical; Connector, Receptacle, Electrical

W-F-406E - Fittings for Cable, Power, Electrical and Conduit, Metal, Flexible

HH-I-558C - Insulation, Blankets, Thermal (Mineral Fiber, Industrial Type)

W-F-408E - Fittings for Conduit, Metal, Rigid (Thick-Wall and Thin-wall Type)

RR-W-410 - Wire Rope and Strand

TT-E-489J - Enamel, Alkyd, Gloss, Low VOC Content

QQ-S-766 - Steel, Stainless and Heat Resisting, Alloys, Plate, Sheet and Strip

C. American Society of Mechanical Engineers (ASME):

A17.1 - Safety Code for Elevators and Escalators

A17.2 - Inspectors Manual for Electric Elevators and Escalators

D. National Fire Protection Association:

NFPA 13 - Standard for the Installation of Sprinkler Systems

NFPA 70 - National Electrical Code (NEC)

NFPA 72 - National Fire Alarm and Signaling Code

NFPA 101 - Life Safety Code

NFPA 252 - Fire Test of Door Assemblies

E. International Building Code (IBC).

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

A1008/A1008M-09 - Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High Strength Low-Alloy with Improved Formability

E1042-02 - Acoustically Absorptive Materials Applied by Trowel or Spray

G. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS):

SP-58 - Pipe Hangers and Supports

H. Society of Automotive Engineers, Inc. (SAE):

J517-91 - Hydraulic Hose, Standard

I. Gauges:

Sheet and Plate: U.S. Standard (USS)

Wire: American Wire Gauge (AWG)

J. American Welding Society (AWS):

D1.1 - Structured Welding Code Steel

K. National Electrical Manufacturers Association (NEMA):
LD-3 - High-Pressure Decorative Laminates

L. Underwriter's Laboratories (UL):
486A - Safety Wire Connectors for Copper Conductors
797 - Safety Electrical Metallic Tubing

M. Institute of Electrical and Electronic Engineers (IEEE)

N. Regulatory Standards:
VA Barrier Free Design Handbook H-18-13
VA Seismic Design Manual H-18-8
Uniform Federal Accessibility Standards

O. National Elevator Industry, Inc.
NEII-1 Building Transportation Standards and Guidelines

1.5 SUBMITTALS

A. Submit in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.

B. Before execution of work, furnish information to evidence full compliance with contract requirements for proposed items. Such information must include, as required: Manufacturer's Name, Trade Names, Model or Catalog Number, Nameplate Data (size, capacity and rating) and corresponding specification reference (Federal or project specification number and paragraph). All submitted drawings and related elevator material must be forwarded to the Contracting Officer.

C. Shop Drawings:

1. Complete scaled and dimensioned layout in plan and section view showing the arrangement of equipment and all details of each elevator unit specified including:

   a. Hoisting machines, controllers, power conversion devices, governors and all other components located in machine room.
   b. Reaction at points of support and buffer impact loads.
   c. Weight of principal parts.
   d. Top and bottom clearances and over travel of car and counterweight.
   e. Location of main line switch/shunt trip circuit breaker, switchboard panel, light switch and feeder extension points in the machine room.

D. Samples:

1. One each of stainless steel, 76 mm x 127 mm (3 in. x 5 in.).
2. One each of baked enamel, 76 mm x 127 mm (3 in. x 5 in.).
3. One each of color floor covering.
4. One each of protection pads, 76 mm x 127 mm (3 in. x 5 in.) if used.
5. One each car and hoistway Braille plate sample.
6. One each car and hall button sample.
7. One each car and hall lantern/position indicator sample.
8. One each wall and ceiling material finish sample.
9. One each car lighting sample.

E. Name of manufacturer, type or style designation and applicable data of the following equipment must be shown on the elevator layouts:
1. Hoisting Machine.
2. Hoisting Machine Motor, HP and RPM ratings, Voltage, Starting and Full Load Ampere and Number of Phases.
3. Controller.
4. Starters and Overload Current Protection Devices.
5. Car and Counterweight Safety Devices; Type “B” safeties, Governor and Rope Gripper.
6. Electric Door Operator; HP, RPM, Voltage and Ampere rating of motor.
7. Hoistway Door Interlocks.
8. Car and Counterweight Buffers; maximum and minimum rated loads, maximum rated striking speed and stroke.
9. Cab Ventilation Unit; HP rating and CFM rating.
10. Hoist and Compensation Ropes, breaking strength, allowable working load and actual working load.

F. Complete construction drawings of elevator car enclosure showing dimensioned details, fastenings to platform, car lighting, ventilation, ceiling framing, top exits and location of car equipment.

G. Complete dimensioned detail of vibration isolating foundations for traction hoisting machines.

H. 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.

I. Cut sheets and drawings showing details of controllers and supervisory panels.

J. Furnish certificates as required under: Paragraph "QUALIFICATIONS".

1.6 WIRING DIAGRAMS

A. 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.

B. In the event field modifications are necessary during installation, diagrams must be revised to include all corrections made prior to and during the final inspection. Corrected diagrams must be delivered to the Resident Engineer/Contracting Officer within thirty (30) days of final acceptance.

C. Provide the following information relating to the specific type of microprocessor controls installed:

1. Owner's information manual, containing job specific data on major components, maintenance and adjustment.
2. System logic description.
3. Complete wiring diagrams needed for field troubleshooting, adjustment, repair and replacement of components. Diagrams must be base diagrams, containing all changes and additions made to the equipment during the design and construction period.
4. Changes made during the construction and warranty period must 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.

1.7 PERFORMANCE STANDARDS

A. The elevators must meet the highest standards of the industry and specifically the following:

1. Contract speed is high speed in either direction of travel with rated capacity load in the elevator. Speed variation under all load conditions, regardless of direction of travel, must not vary more than three (3) percent.
2. The controlled rate of change of acceleration and retardation of the car must not exceed 0.1G per ft/s/s and the maximum acceleration and retardation must not exceed 0.2G per ft/s/s.
3. Starting, stopping and leveling must be smooth and comfortable without appreciable steps of acceleration and deceleration.

B. Passenger/ Service door operator must open the car door and hoistway door at 76.2 cm (2.5 ft) per second and close at 30.5 cm (1 ft) per

second. Freight door operators must open and close at 30.5 cm (1 ft) per second.

C. Floor level stopping accuracy must be within 3 mm (.125 in.) above or below the floor, regardless of load condition.

D. Noise and Vibration Isolation: All elevator equipment including their supports and fastenings to the building, must be mechanically and electrically isolated from the building structure to minimize objectionable noise and vibration transmission to car, building structure, or adjacent occupied areas of building.

E. Sound Isolation: Noise level relating to elevator equipment operation in machine room must not exceed 80 decibels. All decibel readings must be taken 91.4 cm (3 ft) off the floor and 91.4 cm (3 ft) from equipment.

F. Airborne Noise: Measured noise level of elevator equipment during operation must not exceed 50 decibels in elevator lobbies and 60 decibels inside car under any condition including door operation and car ventilation exhaust blower on its highest speed.

1.8 WARRANTY

A. Submit all labor and materials furnished regarding elevator system and installation to terms of "Warranty of Construction" articles of FAR clause 52.246-21. The One-Year Warranty and Guarantee Period of Service must commence and run concurrent after final inspection, completion of performance test and upon acceptance of each elevator.

B. 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 must be removed and a new device meeting all requirements must be installed as part of work until satisfactory operation of installation is obtained. Period of warranty must start anew for such parts from date of completion of each new installation performed, in accordance with foregoing requirements.

1.9 POWER SUPPLY

A. Power supply requirements in each machine room, see Specification 26 05 19, Electrical specifications and Electrical drawings.

B. Main Line Fused Disconnect Switch/Shunt Trip Circuit Breaker for each controller must be located inside the machine room at the strike jamb side of the machine room door and lockable in the “Off” position.

C. Provide Surge Suppressors to protect the elevator equipment.

1.10 EMERGENCY POWER SUPPLY

A. Emergency power supply, its starting means, transfer switch for transfer of elevator supply from normal to emergency power, two pair of conductors in a conduit from an auxiliary contact on the transfer switch (open or close contacts as required by Elevator Controller Manufacturer) to terminals in the group elevator controller and other related work must be provided by the Electrical Contractor.

B. Upon loss of normal power supply there must be a delay before transferring to emergency power of 10 seconds minimum to 45 seconds maximum, the delay must be accomplished through an adjustable timing device.

C. Prior to the return of normal power an adjustable timed circuit must be activated that will cause all elevators to remain at a floor if already there or stop and remain at the next floor if in flight. Actual transfer of power from emergency power to normal building power must take place after all elevators are stopped at a floor with doors open.

D. Car lighting circuits must be connected to the emergency power panel.

1.11 ELEVATOR MACHINE ROOM AND MACHINE SPACE

A. Provide a machine room that meets the requirements of ASME A17.1, NEC, NFPA and IBC. The elevator drive machine and elevator controller must be in the same code approved machine room.

B. Provide stairs and landing for access to the machine room. The landing must be large enough to accommodate full opening of the door plus 61 cm (24 in).

C. Locate the shunt trip breaker/main line disconnect and machine room light switch on the lock side of the door inside the machine room.

D. Locate sprinkler pipes to provide 213.3 cm (7 ft) head clearance. Do not locate sprinkler heads, heat detectors and smoke detectors directly over elevator equipment.

1.12 HOISTWAY LIGHTING

A. Provide lighting throughout the entire hoistway with 3-way switches at the top and bottom of the hoistway accessible from elevator hoistway entrance prior to entering the pit or stepping onto the car top.

B. Lighting must illuminate top of elevator cab when it is at the top floor and the pit when at the bottom floor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Where stainless steel is specified, it must be corrosion resisting steel complying with Fed. Spec. QQ-S-766, Class 302 or 304, Condition A with Number 4 finish on exposed surfaces. Stainless steel must have the grain of belting in the direction of the longest dimension and surfaces must be smooth and without waves. During installation stainless-steel surfaces must be protected with suitable material.

B. Where cold rolled steel is specified, it must be low-carbon steel rolled to stretcher level standard flatness, complying with ASTM A109.

2.2 MANUFACTURED PRODUCTS

A. Materials, devices and equipment furnished must be of current production by manufacturers regularly engaged in the manufacture of such items. The elevator equipment, including controllers, door operators and supervisory system must be the product of manufacturers of established reputation, provided such items are capably engineered and produced under coordinated specifications to ensure compatibility with the total operating system.

B. Manufacturers of equipment assemblies which include components made by others must assume complete responsibility for the final assembled unit. Components must be compatible with each other and with the total assembly for the intended service.

C. Mixing of manufactures related to a single system or group of components must be identified in the submittals.

D. Key operated switches provided for this elevator installation must be provided with four (4) keys for each individual switch or lock. Provide different key tumblers for different switch and lock functions. Each key must have a tag bearing a stamped or etched legend identifying its purpose.

2.3 CONDUIT AND WIREWAY

A. Provide new conduit and wireway. Install electrical conductors, except traveling cable, in rigid zinc-coated steel or aluminum conduit, electrical metallic tubing or metal wireways. Rigid conduit smaller than 19 mm (.75 in.) or electrical metallic tubing smaller than 12.5 mm (.50 in.) electrical trade size must not be used. All raceways completely embedded in concrete slabs, walls, or floor fill must be rigid steel conduit. Wireway (duct) must be installed in the hoistway and to the controller and between similar apparatus in the elevator machine room. Fully protect self-supporting connections, where approved, from abrasion or other mechanical injury. Flexible metal

conduit not less than 9.375 mm (.375 in.) electrical trade size may be used, not exceeding 457 mm (18 in.) in length unsupported, for short connections between risers and limit switches, interlocks and for other applications permitted by NEC.

B. All conduit terminating in steel cabinets, junction boxes, wireways, switch boxes, outlet boxes and similar locations must have approved insulation bushings. Install a steel lock nut under the bushings if they are constructed completely of insulating materials. Protect the conductors at ends of conduits not terminating in steel cabinets or boxes by terminal fittings having an insulated opening for the conductors.

C. Rigid conduit and EMT fittings using set screws or indentations as a means of attachment must not be used.

D. Connect motor or other items subject to movement, vibration, or removal to the conduit or EMT systems with flexible, steel conduits.

2.4 CONDUCTORS

A. Conductors must be new stranded or solid coated annealed copper in accordance with Federal Specification J-C-30B for Type RHW or THW. Where 16 and 18 AWG are permitted by NEC, single conductors, or multiple conductor cables in accordance with Federal Specification J-C-580 for Type TF may be used provided the insulation of single conductor cable and outer jacket of multiple conductor cable is flame retardant and moisture resistant. Multiple conductor cable must have color or number coding for each conductor. Conductors for control boards must be in accordance with NEC. Joints or splices are not permitted in wiring except at outlets. Tap connectors may be used in wireways provided they meet all UL requirements.

B. Provide new conduit and wiring between machine room, hoistway and fixtures.

C. All wiring must test free from short circuits or ground faults. Insulation resistance between individual external conductors and between conductors and ground must be a minimum of one megohm.

D. Where size of conductor is not given, voltage and amperes must not exceed limits set by NEC.

E. Provide equipment grounding. Ground the conduits, supports, controller enclosure, motor, platform and car frame and all other non-current conducting metal enclosures for electrical equipment in accordance with NEC. The ground wires must be copper, green insulated and sized as

required by NEC. Bond the grounding wires to all junction boxes, cabinets and wire raceways.

F. Terminal connections for all conductors used for external wiring between various items of elevator equipment must be solderless pressure wire connectors in accordance with Federal Specification W-S-610. The Elevator Contractor may, at his option, make these terminal connections on #10 gauge or smaller conductors with approved terminal eyelets set on the conductor with a special setting tool, or with an approved pressure type terminal block. Terminal blocks using pierce-through serrated washers are not acceptable.

2.5 TRAVELING CABLES

A. All conductors to the car must consist of new flexible traveling cables conforming to the requirements of NEC. Traveling cables must run from the junction box on the car directly to the controller in the machine room. Junction boxes on the car must 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. Terminal blocks must have permanent indelible identifying numbers for each connection. Cables must be securely anchored to avoid strain on individual terminal connections. Flame and moisture resistant outer covering must remain intact between junction boxes. Abrupt bending, twisting and distortion of the cables must not be permitted.

B. Provide spare conductors equal to 10 percent of the total number of conductors furnished, but not less than 5 spare conductors in each traveling cable.

C. Provide shielded wires for the auto dial telephone system within the traveling cable, five (5) pair shielded wires for card reader, Ethernet cables required for Wi-Fi and other systems, two (2) pair 14-gauge wires for 110 Volt power supply and wire for video display monitor if specified.

D. Traveling cables that contact 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 may be installed from the hoistway suspension point to the elevator pit to prevent traveling cables from rubbing or chafing and securely fastened and tensioned to prevent buckling. Hardware cloth is not required when traveling cable is hung against a flat wall.

2.6 CONTROLLER AND SUPERVISORY PANEL

A. UL/CSA Labeled Controller: Mount all assemblies, power supplies, chassis switches and relays on a steel frame in a NEMA Type 1 General Purpose Enclosure. Cabinet must be securely attached to the building structure.

B. Properly identify each device on all panels by name, letter, or standard symbol which must be neatly stencil painted or decaled in an indelible and legible manner. Identification markings must be coordinated with identical markings used on wiring diagrams. The ampere rating must be marked adjacent to all fuse holders. All spare conductors to controller and supervisory panel must be neatly formed, laced and identified.

C. Controller must be provided with wiring and components for additional future travel if required.

2.7 MICROPROCESSOR CONTROL SYSTEM

A. Provide a new microprocessor control system with absolute position/speed feedback to control dispatching, signal functions, door operation and VVVF Drive for hoist motor control. Complete details of the components and printed circuit boards, together with a complete operational description, must be submitted for approval. Add Regenerative Drive when economically advantages to the VA.

B. Controller manufacturer must provide factory training, engineering and technical support, including all manuals, wiring diagrams and tools necessary for adjusting, maintenance, repair and testing of equipment to the VA for use by the VA’s designated Elevator Maintenance Service Provider.

C. Microprocessor dispatching system must evaluate building traffic demand including number of elevators in service, hall calls, car calls, elevator position, direction of travel, load in elevator, door status and select an elevator to answer hall calls for least possible passenger wait times.

D. Provide means for weighing carload for each elevator. When load in a car reaches an adjustable predetermined level of the rated capacity, that car must bypass registered landing calls until the load in the car drops below the predetermined level. Calls bypassed in this manner must remain registered for the next car. The initial adjustment of the load weighting bypass setting must be 60 to 100 percent.

E. If weight in the car is not commensurate with the number of registered car calls, cancel car calls. Systems that employ either load weighing or door protective device for activation of this feature are acceptable.

D. Control System manufacturer **"MUST"** match Service Elevator number 4. Ensure all software parameters meet or exceed what is supplied with elevator 4.

2.8 MACHINE ROOM MONITOR

A. Provide a monitor in each machine room, separate monitors for each passenger elevator group and each service elevator group. Provide a separate keyboard for each monitor.

B. The monitor must contain indicators to provide the following information:

1. The floor where each elevator is currently located.
2. The direction that each elevator is currently traveling or is scheduled to travel.
3. The location and direction of currently registered hall calls.
4. Elevators that are currently out of service.
5. Elevators that are currently bypassing hall calls.
6. Elevators that are currently engaged in passenger transfers.
7. Operations program under which entire group is currently operating.
8. Zone divisions of the entire group.
9. Door positions.
10. Status indication for elevators on independent service, car top inspection, fire service, earthquake protection and activated stop switch and alarm bell.

C. The maintenance terminal must be suitable for all troubleshooting procedures related to the specific type of microprocessor installed on this project.

2.9 EMERGENCY POWER OPERATION

A. The control system for Elevator(s) must provide for the operation of at least one car per elevator group on emergency power upon failure of the normal power supply.

B. Auxiliary equipment on elevator controllers, wiring between associated elevator controllers and wiring between elevator controllers and remote selector panel as required to permit the elevators to operate as detailed, must be provided by the Elevator Contractor.

C. Upon loss of normal power supply there must be a delay before transferring to emergency power of 10 seconds minimum to 45 seconds maximum, the delay must be accomplished through an adjustable timing device. After adjusting delay, the associated elevators must function the same as on normal power or as follows:

1. Selector switch, Automatic position:
   a. Not more than one elevator at a time in each group must be automatically selected and returned to the main floor, at contract speed, cycle its car and hoistway doors and shut down, with "Door Open" button remaining operable.
   b. As each elevator reaches the designated floor and shuts down, another elevator must start and return to the designated floor.
   c. Elevators that have been manually removed from automatic service and are on independent service, fire service or medical emergency must receive an automatic return signal. Elevators on inspection service or out of service must not receive a signal.
   d. When an elevator is given a signal to return, and it is unable to start its movement to the designated floor within 30 seconds it must be by-passed. When an elevator is by-passed, another elevator must start and return.
   e. This process must continue until all elevators have returned to the designated floor and shut down.
   f. Any elevator or elevators by-passed on initial return signal must be signaled again.
   g. When all cars in group have returned to designated floor, one elevator in each group must be designated for automatic operation. Individual cars in each group must restart at 5 second intervals.
   h. Elevator(s)keyed on to medical emergency service in the car prior to transfer to emergency power operation, medical emergency service must be retained. This elevator must be the first automatically selected elevator to operate on emergency power operation and complete its selected call demand. The elevator will return to the designated floor after the key switch is reset to normal position.
2. Selector switch, Manual operation:

a. Selector switch must be mechanically and electrically interlocked to prevent the selection of more than one elevator from operating on emergency power.
b. The selector switch must have positions marked with the number of each elevator controlled. It must also have a position marked "Automatic". When the selector switch is set to the automatic position, the medical emergency service car must operate on emergency power operation, or if none, the last car arriving at the designated floor must operate on emergency power operation.
c. Change in selection of elevators must be by means of the selection switch and must occur only when the previous selected elevator is stopped at the designated floor.
d. The selector switch must be locked out of operation when the system is in the normal mode of operation.
e. Locate the selector switch above the hall push button at the designated level. The key switch must be a tumbler type lock furnished with four keys. The enclosure faceplate must be identified "Emergency Power Control" with 12.5 mm (.50 in.) engraved letters filled with black paint.

D. Prior to the return of normal power an adjustable timer circuit must activate that will cause all cars to remain at a floor if already there or stop and remain at the next floor if in flight. Actual transfer of power from emergency power to normal building power must take place after all cars are stopped at a floor with their doors open.

E. Emergency Rescue Operation:
Provide a power source to send the elevator to the nearest landing. After the elevator has leveled at the nearest landing, provide power to open the car and hoistway doors automatically. After a predetermined time, the doors must close. Power must stay applied to the door open button to reopen the doors from the inside of the elevator. The elevator must remain shut down at the landing until normal power is restored. Install a sign on the controller indicating that power is applied to emergency rescue operator and door operator during loss of normal power.

2.10 FIREFIGHTER'S SERVICE

A. Provide Firefighter's Service. Key switches must be barrel-key FEO-K1.
1. Main Floor:

2. Alternate Floor:
3. Verify main and alternate floors with RE/CO or authorized representative.

2.11 INDEPENDENT SERVICE

A. Provide an INDEPENDENT SERVICE key switch on the face of the main car operating panel or a toggle switch in the service operating panel that must have its positions marked "ON" and "OFF". When the switch is in the "ON" position, the car must respond only to calls registered on its car dispatch buttons and must bypass all calls registered on landing push buttons. The car must start when a car call is registered, car call button or door close button is pressed, car and hoistway doors are closed and interlock circuits are made. When switch is returned to "OFF" position, normal service must be resumed.

2.12 MEDICAL EMERGENCY SERVICE – PATIENT CARE FACILITIES ONLY

A. Provisions must be made for calling elevator(s) to floors served by the elevator on an emergency basis, operating independently from the dispatch signals and landing call signals.
B. Install key switches in the floor landing push button fixtures above the push buttons.
C. Provide a call registered light indicator adjacent to key switch. The key switch at the landings and in the car, must only be operable by authorized personnel with a key.
D. When a key switch is activated at any floor, the call register light indicator must illuminate at the call floor and inside the elevator. The elevator control system must instantly select an elevator to respond to the medical emergency call. Immediately upon selection, all car calls must be cancelled. If car is traveling away from the medical emergency call, it must slow down and stop at the nearest floor, maintain closed doors, reverse direction and proceed nonstop to the medical emergency call floor. If the car is traveling toward the medical emergency call floor, it must proceed to that floor nonstop. If at the time of selection, it is slowing down for a stop, the car must stop, maintain doors closed and start immediately toward the medical emergency floor.
E. Arriving at the medical emergency floor, the car must remain with doors open for 60 seconds. After this interval has expired and the car has not been placed on medical emergency operation inside the car, the car must automatically return to normal service.

F. Provide an LED illuminated indicator light next to the Medical Emergency key switch the same size as the Fire Service indicator.
   1. Locate a “Medical Emergency” key switch above call buttons in the main car operating panel for selecting medical emergency service. Activation of the key switch will allow the car to accept a car call for any floor, close doors and proceed nonstop to the floor desired.
   2. After medical emergency call has been completed the elevator must return to normal operation after the key is removed.

G. In the center of the rear cab panel provide a back lighted "MEDICAL EMERGENCY" LED illuminated display that must flash on and off continuously when the car is assigned to this operation and until it is restored to normal service. "MEDICAL EMERGENCY" indicator must be a photographic negative type 1828 mm (72 in.) to center above the floor, 152 mm (6 in.) wide X 76 mm (3 in.) high, with 12.5 mm (.50 in.) high letters legible only when illuminated.

H. Elevators being operated on “Independent Service”, the medical emergency service indicator lights in the car operating panel and rear wall must be illuminated, buzzer must sound and the “Audio Voice” system must direct the attendant to return the car to automatic operation.

I. If the car is out of service and unable to answer medical emergency calls, the call register light must not illuminate.

J. Each key switch must have its identity legible and indelible engraved in faceplates. All lettering must be 6 mm (.25 in.) high, filled with black paint.

K. When Phase I firefighter’s recall is activated, it must over-ride elevators on medical emergency service and return them to the main or alternate fire service recall floor. When the fire emergency floor has been identified the attendants may complete their medical emergency run on Phase II firefighter’s operation if life safety is not affected.

2.13 SEISMIC REQUIREMENTS

A. Meet the requirements of VA Seismic Design Manual H-18-8.

2.14 ELEVATOR MACHINE BEAMS RETAIN EXISITING

A. Overhead beams must support machines and machinery in place to prevent movement under any conditions imposed in service.

2.15 TRACTION HOIST MACHINE

A. Provide new gearless traction machine with an AC motor, brake, drive sheave and deflector sheave mounted in proper alignment on an isolated bedplate.

B. Provide hoist machine mounted direct drive, digital, closed-loop velocity encoder.

C. Drive sheaves must be free from cracks, sand holes and other imperfections that would tend to injure the hoist ropes. Sheave must be turned smooth and true with rope grooves of proper design to insure maximum traction and maximum life of the hoist ropes.

D. Hoisting machine brake must be drum or disc type and must stop and hold the elevator with 125 percent of rated load.

2.16 DEFLECTOR SHEAVES

A. Provide new deflector sheaves with a metal guard mounted below the sheave and a guard to prevent ropes from jumping out of grooves. Securely fasten guard to sheave support beams.

B. Securely mount overhead sheaves on overhead beams in proper alignment with basement traction sheave, car and counterweight rope hitches or sheaves. Provide blocking beams where sheaves are installed on two or more levels.

2.17 HOIST ROPES

A. Provide elevator with the required number and size of new ropes to ensure adequate traction and required safety factor. Hoisting ropes must be pre-formed 8x19 or 8x25 traction steel, conforming to Federal Specification RR-W-410 with minimum nominal diameter of 12.5 mm (.50 in.).

B. Securely attach a corrosion resistant metal data tag to one hoisting rope fastening on top of the elevator.

2.18 HOIST ROPE COMPENSATION

A. Provide hoist rope compensation when required by elevator controller or drive machine manufacturer. Compensation must consist of a necessary number and size of encapsulated chains attached to the underside of car and counterweight frames.

1. Provide guide(s) in pit to minimize chain sway.
2. Provide take-up adjustment to compensate for hoist rope stretch.
3. Pad areas where compensation may strike car or hoistway items.

2.19 GOVERNOR ROPE

A. New Governor Rope must be 6x19 or 8x19 wire rope, preformed traction steel, uncoated, fiber core, conforming to Federal Specification RR-W-

410 with minimum nominal diameter of 9 mm (.375 in.) having a minimum safety factor of 5. Tiller rope construction is not acceptable.

B. Under normal operation rope must run free and clear of governor jaws, rope guards and other stationary parts.

C. Securely attach governor rope tag to governor rope releasing carrier.

2.20 SPEED GOVERNOR

A. Provide Centrifugal car driven governor to operate the car safety device. Governor must be complete with weighted pit tension sheave, governor release carrier and mounting base with protected cable sleeves.

B. Provide overspeed switch and speed reducing switches when required.

C. The governor rope clamping device must be designed to prevent appreciable damage to or deformation of the governor rope that results from the stopping action of the device operating the safety.

D. Provide metal guard over top of governor rope and sheaves.

E. Where the elevator travel does not exceed 100 feet, the weight tension sheave may be mounted on a pivoted steel arm in lieu of operating in steel guides.

2.21 CAR SAFETY DEVICE

A. Provide new “Type B Safeties” on the elevator and counterweight.

2.22 ASCENDING CAR OVERSPEED PROTECTION

A. Provide a device, direct acting on the suspension means, to prevent ascending over speed and unintended motion away from the landing when the doors are not closed and locked.

2.23 CAR AND COUNTERWEIGHT BUFFERS

A. Provide new buffers for each car and each counterweight. Securely fasten buffers and supports to the pit channels and in the alignment with striker plates on car and counterweight. Each installed buffer must have a permanently attached metal plate indicating its stroke and load rating. Buffer anchorage must not puncture pit waterproofing.

2.24 COUNTERWEIGHTS

A. Elevator must be counterweighted with the weight of the car plus 40-50 percent of the rated capacity load as required by the controller manufacturer.

B. Provide new counterweight guard if required. If compensation chains are required remove counterweight guards.

2.26 NORMAL AND FINAL TERMINAL STOPPING DEVICES

A. Mount new terminal slowdown switches and direction limit switches on the elevator or in hoistway to reduce speed and bring car to an automatic stop at the terminal landings.
   1. Switches must function with load up to and including 125 percent of rated elevator capacity at contract speed during normal operation.
   2. Switches, when opened, must permit operation of elevator in reverse direction of travel.

B. Mount final terminal stopping switches in the hoistway.
   1. Switches must be positively opened should the car travel beyond the terminal direction limit switches.
   2. Switches must be independent of other stopping devices.
   3. Switches, when opened, must remove power from hoist motor, apply hoist machine brake and prevent operation of car in either direction.

2.27 CROSSHEAD DATA PLATE AND CODE DATA PLATE

A. Permanently attach a non-corrosive metal Data Plate to car crosshead.

B. Permanently attach a non-corrosive Code Data Plate to the controller.

2.28 WORKMAN'S LIGHTS AND OUTLETS

A. Provide new duplex GFCI protected receptacles and lamps with guards on top of each elevator car and beneath the platform. The receptacles must be in accordance with Fed. Spec. W-C-596 for Type D7, 2-pole, 3-wire grounded, rated for 15 amperes and 125 volts.

2.29 CARTOP OPERATING DEVICE

A. Provide a new cartop operating device.

B. The device must be activated by a toggle switch mounted in the device. The switch must be clearly marked "INSPECTION" and "NORMAL" on the faceplate, with 6 mm (.25 in.) letters.

C. Movement of the elevator must be accomplished by the continuous pressure on a direction button and a safety button.

D. Provide an emergency stop switch, push to stop/pull to run.

E. Provide permanent identification for the operation of all components in the device.

F. The device must be permanently attached to the elevator crosshead on the side of the elevator nearest to the hoistway doors used for accessing the top of the elevator.

2.30 LEVELING DEVICE

A. Elevator must be equipped with a new two-way leveling device to automatically bring the car to within 3 mm (.125 in.) of exact level with the landing for which a stop is initiated regardless of load in car or direction of travel.

B. If the car stops short or travels beyond the floor, the leveling device, within its zone must automatically correct this condition and maintain the car within 3 mm (.125 in.) of level with the floor landing regardless of the load carried.

2.31 EMERGENCY STOP SWITCHES

A. Provide an emergency stop switch, push to stop/pull to run, for each cartop device, pit, machine spaces, service panel and firefighter’s control panel inside the elevator. Mount stop switches in the pit adjacent to pit access door, at top of the pit ladder 1219 mm (48 in.) above the bottom landing sill and 1219 mm (48 in.) above the pit floor adjacent to the pit ladder.

B. Each stop switch must be red in color and must have "STOP" and "RUN" positions legibly and indelibly identified.

2.32 MAIN CAR OPERATING PANEL

A. Provide new main car operating panel in the car enclosure on the front return panel for passenger/service elevators. The top floor car call push button must not be more than 1219 mm (48 in.) above the finished floor. “Vandal Resistant” car push buttons and indicator lights must be LED illuminated, round with a minimum diameter of 25 mm (1 in.). Each button must contain an integral registration LED light which must illuminate upon registration of a call and must extinguish when that call is answered.

B. One-piece hinged front faceplate with edges beveled 15 degrees must have the firefighter’s service panel recessed into the upper section and the service operation panel recessed into the lower section fitted with hinged doors. Doors must have concealed hinges, be in the same front plane as the faceplate and fitted with key operated locks. Secure the faceplate with stainless steel tamperproof screws.

C. All terminology and tactile symbols on the faceplate must be on square or rectangular plates recessed into the faceplate with its surface flush with the surface of the faceplate. Use 6 mm (.25 in.) letters to identify all devices in the faceplate. The tactile symbols with contrasting background must be 12.5 mm (.50 in.) high raised .075 mm (.030 in.) on the plate. Surface mounted plates are not acceptable.

D. The upper section must contain the following items in order listed from top to bottom:

1. Elevator number, 12.5 mm (.50 in.) high with black paint for contrast.
2. Capacity plate information with black paint for contrast with freight loading class and number of passengers allowed.
3. LED illuminated digital car position indicator with direction arrows.
4. Emergency car lighting system consisting of a rechargeable battery, charger, controls and LED illuminated light fixture. The system must automatically provide emergency light in the car upon failure or interruption of the normal car lighting service and function irrespective of the position of the light control switch in the car. The system must maintain a minimum illumination of 1.0 foot-candle when measured 1220 mm (48 in.) above the car floor and approximately 305 mm (12 in.) in front of the car operating panel, for not less than four (4) hours.
5. Firefighter’s Emergency Operation Panel must be 167.6 cm (66 in.) minimum to 183 cm (72 in.) maximum to the top of the panel above finished floor.
6. Firefighter’s Emergency Indicator Light must be round with a minimum diameter of 25 mm (1 in.).
7. Medical Emergency key switch marked “MEDICAL EMERGENCY” with two positions labeled “ON” and “OFF” and Medical Emergency Indicator Light located next to the key switch must be round with a minimum diameter of 25 mm (1 in.). Instruction for Medical Emergency operation must be engraved below the key switch and light.
8. Key operated Independent Service Switch on the face of panel. (Delete if inside service panel.)

9. Provide a Door Hold Button on the faceplate above the call buttons. It must have "DOOR HOLD" indelibly marked on the button. Button must light when activated. When activated, the door must stay open for a maximum of one minute. To override hold timer, push a car call button or door close button.
10. Provide round "Vandal Resistant" car push buttons and indicator lights, minimum diameter of 25 mm (1 in.) and LED illuminated corresponding to the floors served. Car buttons must be legibly and indelibly identified by a floor number, letter, or symbol not less than 12.5 mm (.50 in.) high in the face of the button or indicator.
11. Door Open and Door Close buttons must be located below the car call buttons. They must have "OPEN" and "CLOSE" legibly and indelibly identified by letters in the face of the respective button. Door Open button must be located closest to the door jamb.
12. Red Emergency Alarm button that must be located below the car operating buttons. Mount the emergency alarm button not lower than 889 mm (35 in.) above the finished floor. It must be connected to audible signaling devices. Provide audible signaling devices including the necessary wiring.
13. Emergency Help push button must activate two-way communications by Auto Dial telephone system that is compatible with the VAMC's telephone system. Help button must be LED illuminated and flash when call is acknowledged. Legibly and indelibly label the button "HELP" in the face of the button with 12.5 mm (.50 in.) high letters.

E. The service operation panel in the lower section must contain the following items:
1. Light switch labeled "LIGHTS" for controlling interior car lighting with its two positions marked "ON" and "OFF".
2. Inspection switch that will disconnect normal operation and activate hoistway access switches at terminal landings. Switch must be labeled "ACCESS ENABLE" with its two positions marked "ON" and "OFF".
3. Three-position switch labeled "FAN" with its positions marked "HIGH", "LOW" and "OFF" for controlling car ventilating blower.
4. Two-position, spring return toggle switch or push button to test the emergency light and alarm device. It must be labeled "TEST EMERGENCY LIGHT AND ALARM".

5. Two-position toggle switch labeled “Independent Service” with its positions marked “ON” and “OFF”. (Delete if on face of panel).

6. Two-position emergency stop switch, when operated, must interrupt power supply and stop the elevator independently of regular operating devices. Emergency stop switch must be marked “PUSH TO STOP” and “PULL TO RUN”.

2.33 AUXILIARY CAR OPERATING PANEL

A. Provide an auxiliary car operating panel in the side wall of the elevator between the handrails immediately adjacent to the front entrance column strike jamb. The auxiliary car operating panel must contain only those controls essential to passenger (public) operation. The auxiliary car operating panel faceplate must match the main car operating panel faceplate in material and general design. Secure the faceplate with stainless steel tamperproof screws.

1. Provide round “Vandal Resistant” car push buttons and indicator lights, minimum diameter 25 mm (1 in.) and LED illuminated corresponding to the floors served. Car buttons and indicator lights must be legibly and indelibly identified by a floor number, letter, or symbol not less than 12.5 mm (.50 in.) high in the face of the button or indicator light corresponding to the main car operating panel buttons or indicator light.
2. Door "OPEN" and door "CLOSE" buttons must be closest to the door jamb and the alarm button must be 889 mm (35 in.) above the finished floor. The Door Open button must be located closest to the door.
3. Cross-connect all buttons in the auxiliary car operating panels to their corresponding buttons in the main car operating panel. Registration of a car call must cause the corresponding button to illuminate in the main and auxiliary car operating panel.
4. Emergency Help push button must activate two-way communications by auto dial telephone that is compatible with the VAMC’s telephone system. Help button must be LED illuminated and flash when call is acknowledged. Legibly and indelibly label the button “HELP” in the face of the button with 12.5 mm (.50 in.) high letters.

B. All terminology and tactile symbols on the faceplate must be on square or rectangular plates recessed into the faceplate with its surface flush with the surface of the faceplate. Use 6 mm (.25 in.) letters to identify all devices in the faceplate. The tactile symbols with

contrasting background must be 12.5 mm (0.5 in.) high raised .075 mm (.030 in.) on the plate. Surface mounted plates are not acceptable.

2.34 CAR POSITION INDICATOR

A. Provide an alpha-numeric digital car position indicator in the main car operating panel, consisting of numerals and arrows 63 mm (2.5 in.) high, to indicate position of car and direction of car travel. Locate position indicator at the top of the main car operating panel, illuminated by light emitting diodes.

2.35 AUDIO VOICE SYSTEM & VIDEO REQUIRMENTS PER A17.1- 2022

A. Provide digitized audio voice system. Audio voice must announce floor designations, direction of travel and special announcements. The voice announcement system must be a natural sounding human voice that receives messages and must comply with ADA requirements for audible car position indicators. The voice announcer must have two separate volume controls, one for the floor designations and direction of travel and another for special announcements. The voice announcer must have a full range loudspeaker, located on top of the cab. The audio voice unit must contain the number of ports necessary to accommodate the number of floors, direction messages and special announcements. Install voice announcer per manufacturer’s recommendations and instructions. The voice system must be the product of a manufacturer of established reputation. Provide manufacturer literature and list of voice messages.

1. Fire Service Message.
2. “Please do not block doors”.
3. Provide special messages as directed by COR.
4. A means to display video to observe passengers at any location on the car floor, to emergency personnel for entrapment assessment, shall be provided.

2.36 AUTO DIAL TELEPHONE SYSTEM

A. Provide a complete, ADA compliant, auto dial communication system that is compatible with the VAMC’s telephone system.

B. Two-way communication device must be in full compliance with ASME A17.1 Rule 2.27.1.1 (2019) or later editions.

2.37 CORRIDOR OPERATING DEVICES

A. Provide new corridor operating device faceplates must be 3 mm (.125 in.) thick flat stainless steel with all edges beveled 15 degrees.

B. Corridor push button faceplates must be sized to accommodate corridor pictograph on faceplate. The centerline of the landing push buttons must be 106.6 cm (42 in.) above the corridor floor.

C. Elevator Corridor Call Station Pictograph must be engraved in the faceplate.

D. Fasten corridor operating devices and signal device faceplates with stainless steel tamperproof screws.

E. All terminology and tactile symbols on the faceplate must be raised .030 inch with contrasting background, on square or rectangular plates recessed into the faceplate with its surface flush with the surface of the faceplate. The handicapped markings with contrasting background must be 12.5 mm (.5 in.) high raised .075 mm (.030 in.) on the plate, square or rectangular. Use 6 mm (.25 in.) letters to identify all other devices in the faceplate. Surface mounted plates are not acceptable.

F. Provide call buttons for each elevator or group of elevators as shown on contract drawings.

G. “Vandal Resistant” hall buttons and indicator lights must be LED illuminated upon registration of a call and shall extinguish when that call is answered.

H. The direction of each button must be legibly and indelibly identified by arrows not less than 12.5 mm (.50 in.) high in the face of each button. Provide a corresponding Braille plate on the left side of each button.

I. Hall call buttons must not re-open the doors while the car and hoistway doors are closing at that floor, the call must be registered for the next available elevator. Calls registered must be canceled if closing doors are re-opened by means of "DOOR OPEN" button or infrared curtain unit.

J. Provide emergency power indicator light, medical emergency key switch and indicator light, fire service recall key switch and indicator light, firefighter’s recall instruction, communication failure light, audible enunciator and reset key switch in the fixture at the designated main floor.

K. Submit design of hall pushbutton fixtures for approval.

2.38 CORRIDOR ARRIVAL LANTERN/POSITION INDICATOR

A. Provide new combination corridor arrival lantern/position indicator digital display mounted above hoistway entrances at each floor in healthcare facilities. For non-healthcare facilities provide

combination fixtures only at main and alternate fire recall floors unless specified for all floors. Provide each terminal landing with "UP" or "DOWN", minimum 63 mm (2.5 in.) high arrow lanterns and each intermediate landing with "UP" and "DOWN" arrow lanterns. Each lens must be LED illuminated of proper intensity, shielded to illuminate individual lens only. The lenses in each lantern must be illuminated green to indicate "UP" travel and red to indicate "DOWN" travel. Lanterns must signal in advance of car arrival at the landing indicating the direction of travel. Corridor lanterns must not be illuminated when a car passes a floor without stopping. Each lantern must be equipped with an audible electronic chime which must sound once for "UPWARD" bound car and twice for "DOWNWARD" bound car. Audible signal must not sound when a car passes the floor without stopping. Provide adjustable sound level on audible signal. Car riding lanterns are not acceptable.

B. Install alpha-numeric digital position indicator between the arrival lanterns. Indicator faceplate must be stainless steel. Numerals must be not less than 63 mm (2.5 in.) high with direction arrows. Cover plates must be readily removable for re-lamping. The appropriate direction arrow must be illuminated during entire travel of car in corresponding direction.

2.39 HOISTWAY ACCESS

A. Provide new hoistway access switches for elevator at top terminal landing to permit access to top of car and at bottom terminal landing to permit access to pit. Elevators with side slide doors, mount the access key switch 182.8 cm (6 ft) above the corridor floor in the wall next to the strike jamb.

B. Exposed portion of each access switch or its faceplate must have legible, indelible legends to indicate "UP", "DOWN" and "OFF" positions.

C. Each access switch must be a constant pressure cylinder type lock having not less than five pins or five stainless steel disc combination with key removable only when switch is in the "OFF" position.

D. Lock must not be operable by any other key which will operate any other lock or device used for any other purpose at the VA Medical Center.

E. Arrange the hoistway switch to initiate and maintain movement of the car. When the elevator is operated in the down direction from the top terminal landing, limit the zone of travel to a distance not greater

than the top of the car crosshead level with the top floor. Submit design and location of access switches for approval.

F. Provide emergency access for all hoistway entrances, keyways for passenger and service elevators.

2.40 HOISTWAY ENTRANCES: SERVICE ELEVATORS

A. Provide raised numerals or letters on cast, rear mounted plates for all openings. Numerals must be a minimum of 51 mm (2 in.) high, located on each side of entrance frame, with centerline of 152.3 cm (5 ft) above the landing sill. The number plates must contain Braille.

B. Provide unique car number on every elevator entrance at designated main and alternate fire service floor levels, minimum 76 mm (3 in.) in height.

C. Provide new stainless steel hoistway doors. Door panels must be flush hollow metal construction, not less than 32 mm (1.25 in.) thick, consisting of one continuous piece 16-gauge stainless steel on corridor side wrapped around the leading edge. Separate two plates by a sound-deadening material and reinforce by steel shapes welded to the plates at frequent intervals. Reinforce panels as required for installation of hangers, power-operating and door-opening devices. Top and bottom of door panels must have continuous stiffener channels welded in place. Reinforcement of the door panels must be a minimum of 1.0 mm (0.04 in.) in thickness and of the hat section type.

D. Hang doors on two-point suspension hangers having sealed ball-bearing sheaves not less than 76 mm (3 in.) in diameter, with non-metallic sound-reducing tires. Equip hangers with adjustable ball-bearing rollers to take upward thrust of panels. Provide two removable non-metallic door gibs of approved material and a separate fire gib at the bottom of each door panel. Gibs must be replaceable without removing of door panel. One door panel for each entrance must bear a BOCA label, Underwriters' label, or other labels may be furnished provided they are based on fire test reports and factory inspection procedures acceptable to the COR. Fasten stainless steel sight guard of 14-gauge metal, extending full height of panel, to leading edge of fast speed panel of two-speed doors.

E. Door panels for each entrance must bear a BOCA label, Underwriters' label or labels from other accredited test laboratories may be furnished provided they are based on fire test reports and factory

inspection procedures acceptable to the RE/CO or authorized representative.

F. Provide 14-gauge sheet steel fascia plates in hoistway to extend vertically from head of hanger support housing to sill above. Plates must be 76 mm (3 in.) wider than door opening of elevator and 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.

G. Equip each hoistway entrance with new electrical/mechanical interlock, functioning as hoistway unit system, to prevent operation of elevator until all hoistway doors are locked in the closed position unless car is operating in the leveling zone or hoistway access switch is used.

H. Wiring installed from the hoistway riser to each door interlock must be NEC type SF-2 or equivalent.

2.41 CAR AND COUNTERWEIGHT GUIDES

A. Provide new adjustable roller guides each assembled on a substantial metal base, to permit individual alignment to the guide rails.

B. Each guide must consisting of not less than three (3) wheels, each with durable, resilient oil-resistant material tires rotating on ball bearings having sealed-in lubrication. Assemble rollers on a substantial metal base and mount to provide continuous spring pressure contact of all wheels with the corresponding rail surfaces under all conditions of loading and operation. Secure the roller guides at top and bottom on each side of car frame and counterweight frame. All mounting bolts must be fitted with nuts, flat washers, split lock washers and if required, beveled washers.

C. Provide sheet metal guards to protect rollers on top of car and counterweight.

D. Minimum diameter of car rollers must be 152 mm (6 in.). The entire elevator car must be properly balanced to equalize pressure on all guide rollers. Cars must be balanced in post-wise and front-to-back directions. Test for this balanced condition must be witnessed at time of final inspection.

E. Minimum diameter of counterweight rollers must not be less than 101 mm (4 in.). Properly balance counterweight frame to equalize pressure on all guide rollers. The Contractor must have the option of furnishing, for counterweight only, mechanically adjusted roller guide in lieu of spring-loaded roller guides as specified.

F. Equip car and counterweight with an auxiliary guiding device for each guide that must prevent the car or counterweight from leaving the rails if the normal guides fail. These auxiliary guides must not, during normal operation, touch the guiding surfaces of the rails. The auxiliary guides may be an extension of the normal guide mounting plate if that plate is fabricated from hot rolled steel. The portion of the auxiliary guide that contacts the rail surfaces in the event of loss of the normal guides must be lined with an approved bearing material to minimize damage to the rail guiding surfaces.

2.42 CAR FRAME: SERVICE ELEVATORS

A. Retain Current Frames

2.43 CAR PLATFORM: SERVICE ELEVATORS

A. Retain Current Platform

2.44 CAR ENCLOSURE: PASSENGER/SERVICE ELEVATORS

A. Car enclosure must have a minimum dome height inside the cab of 244 cm (8 ft).

B. Securely fasten car enclosure to platform by through bolts located at intervals of not more than 457 mm (18 in.) running through an angle at the base of panels to underside of platform.

C. Front return wall panel, entrance columns, entrance head-jamb and transom must be 14-gauge stainless steel. Transom must be full width of cab. Side and rear walls must be constructed of 14-gauge cold rolled steel. Coat exterior of walls with mastic sound insulation material approximately 2.5 mm (.10 in.) thick followed by a prime coat of paint.

D. Side and rear walls of passenger elevators may have raised panels covered in fire rated materials approved for use in elevator interior.

E. Side and rear walls of service elevators, up to the center line of the top handrail, must be covered with stainless steel. Side and rear walls to the ceiling must be covered with stainless steel applied directly to the cab walls or raised panels. Submit a method of fastening panels to steel walls.

F. Construct canopy of not less than 12-gauge steel.

G. Provide car top railings.

H. Provide a hinged top emergency exit cover. Exit must be unobstructed when open and must have mechanical stops on the cover. Provide an exit switch to prevent operation of the elevator when the emergency exit is open.

I. Provide duplex, GFCI protected receptacle in car. Locate flush-mounted receptacle on the centerline of the main car operating panel, 150 mm (6 in.) above the car floor.

J. Lighting for passenger/service elevators:

1. Provide stainless steel hanging ceiling frame. Construct frame of 3.125 mm (.125 in.) thick x 38 mm (1.50 in.) wide x 38 mm (1.50 in.) high "T" and "L" sections, divide ceiling into six panels.
2. Provide LED illuminated car light fixtures above the ceiling panels. Maintain a minimum light level of 50-foot candles at 914 mm (36 in.) above the finished floor.

K. Optional lighting for service elevators:

1. Provide car with indirect LED lamps mounted front to rear in lighting coves along each side of the cab ceiling, no hanging ceiling.
2. Equip the lighting cove with asymmetrical reflectors having specular finish. Maintain a minimum light level of 50-foot candles 914 mm (36 in.) above finished floor at the car operating panels.
3. Enclose the entire vertical space between the light trough outer edge and the cab canopy with approved opaque white or clear lumicite sheeting. Lumicite sheeting must be removable for cleaning and re-lamping.

L. Provide a blower unit arranged to exhaust through an opening in the canopy. Provide a stainless or chrome plated fan grill on the interior side of the opening. Provide screening over intake and exhaust end of blower. Provide 2-speed fan, with rated air displacement of 250 cfm and 400 cfm at respective speeds. Mount fan on top of car with rubber isolation to prevent transmission of vibration to car structure. Provide a 3-position switch to control the unit in the service panel.

M. Provide car enclosure with two sets of handrails with centerlines 762 mm and 1067 mm (30 in. and 42 in.) above the car floor, circumference not to exceed 15.2 cm (6 in.).

1. Locate handrails 38 mm (1.50 in.) from cab wall. Install handrails on side and rear walls. Conceal all handrail fastenings. Handrails must be removable from inside the car enclosure.
2. Provide service elevators with flat stock handrails with the ends at the entrance turned back to the wall.

N. Provide passenger car with center opening horizontal sliding doors and service car with center or side opening horizontal sliding doors

constructed the same as hoistway doors. Door panels must be not less than 16-gauge sheet steel and not less than 32 mm (1.25 in.) thick flush type construction with the car side and leading edge wrapped in one continuous piece of 16-gauge stainless steel. Top and bottom of door panels must have continuous stiffener channels welded in place. Reinforcement of the door panels must be approximately 1.0 mm (0.04 in.) in thickness and of the hat section type. Reinforce each door panel for hangers, interlock mechanism, opening and closing devices. Do not use hangers that are constructed integrally with the door panels.

O. Hang doors on two-point suspension hangers having sealed ball-bearing sheaves not less than 76 mm (3 in.) in diameter, with non-metallic sound-reducing tires. Equip hangers with adjustable ball-bearing rollers to take upward thrust of panels. Provide two non-metallic door gibs on each door panel and a separate fire gib. Gibs must be replaceable without removing of door panel. One door panel for each entrance must bear a BOCA label, Underwriters' label, or other labels may be furnished provided they are based on fire test reports and factory inspection procedures acceptable to the COR. Fasten stainless steel sight guard of 14-gauge metal, extending full height of panel, to leading edge of fast speed panel of two-speed doors.

P. Provide new hardware, tracks, gibs, separate fire gibs, gate switch, door drive clutch assemblies and door restrictor.

Q. Provide one set of protective pads for service elevator of sufficient length to completely cover two sides, rear walls and front return of cab interior. Pads must consist of a minimum of 6 mm (.25 in.) thick glass fiber insulation securely sewn between flame resistant vinyl coated coverings. Color of the covering must be approved by the RE/CO or their representative. Provide stainless steel pad buttons or hooks, spaced at intervals of not more than 457 mm (18 in.) to adequately support pads.

2.45 POWER DOOR OPERATORS: SERVICE ELEVATORS

A. Provide a new high-speed heavy-duty door operator to automatically open the car and hoistway doors simultaneously when the car is level with the floor and automatically close the doors simultaneously at the expiration of the door-open time. Provide microprocessor door control with circuitry to constantly monitor and automatically adjust door operation based upon velocity, position and motor current. Motor must be of the high-internal resistance type, capable of withstanding high

currents resulting from stall without damage to door operator or motor. The door operator must open the car door and hoistway door simultaneously, at a speed of 76.2 cm (2.5 ft) per second. Closing speed of the doors must be 30.5 cm (1 ft) per second. Reversal of direction of the doors from the closing to opening operation, whether initiated by obstruction of the infrared curtain or the door "OPEN" button, must be accomplished within 38 mm (1.50 in.) maximum of door movement. Emphasis is placed on obtaining quiet interlock and door operation; smooth, fast, dynamic braking for door reversals and stopping of the doors at extremes of travel.

B. Equip car doors with electric contact that prevents operation of car until doors are closed unless car is operating in leveling zone or hoistway access switch is used. Locate door contact to prevent its being tampered with from inside of car.

C. Car and hoistway doors must be manually operable in an emergency without disconnecting the power door operating equipment unless the car is outside the unlocking zone.

1. Doors must not open by power unless the elevator is in the leveling zone.
2. Provide infrared curtain unit. The device must cause the car and hoistway doors to reverse automatically to the fully open position should the unit be actuated while the doors are closing. Unit must function when the doors are not closed, except during firefighter’s operation.

D. Should the doors be prevented from closing for more than a predetermined adjustable interval of 15 to 30 seconds by operation of the curtain unit, the doors must stay open, the audio voice message and a buzzer located on the car must sound only on automatic operation. **Do not provide door nudging.**

1. If an obstruction of the doors does not activate the photo-electric door control device and prevent the doors from closing for more than a predetermined adjustable interval of 15 to 30 seconds, the doors must reverse to the fully open position and remain open until the “Door Close” button re-establishes the closing cycle.

E. Provide door "OPEN" and "CLOSE" buttons. When the door "OPEN" button is pressed and held, the doors, if in the open position, must remain open and if the doors are closing, they must stop, reverse and re-open.

Momentary pressure of the door "CLOSE" button must initiate the closing of the doors prior to the expiration of the normal door open time.

PART 3 – EXECUTION

3.1 PREPARATION

A. Examine work of other trades on which the work of this Specification depends. Report defects to the RE/CO or authorized representative in writing that may affect the work of the elevator contractor.

B. Examine elevator hoistway openings for plumb, level, in line and that elevator pit is proper size, waterproofed and drained with necessary access door and ladder.

C. Examine machine room for proper illumination, heating, ventilation, electrical equipment and beams are correctly located complete with access stairs and door.

D. If the Elevator Contractor requires changes in size or location of trolley beams, beam supports and trap doors, etc., to accomplish their work, changes must be justified, subject to approval of the Contracting Officer and include additional cost in their bid.

E. Work required prior to the completion of the elevator installation:
   1. Supply of electric feeder wires to the terminals of the elevator control panel, including circuit breaker.
   2. Provide light and GFCI outlets in the elevator pit and machine room.
   3. Furnish electric power for testing and adjusting elevator equipment.
   4. Furnish circuit breaker panel in machine room for car and hoistway lights and receptacles.
   5. Supply power for cab lighting and ventilation from an emergency power panel specified in Division 26, ELECTRICAL.
   6. Machine room enclosed and protected from moisture, with self-closing, self-locking door and access stairs.
   7. Provide fire extinguisher in machine room.

F. Provide to General Contractor for installation; inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.

3.2 ARRANGEMENT OF EQUIPMENT

A. Arrange equipment in machine room so that major equipment components can be removed for repair or replacement without dismantling or removing other equipment in the same machine room. Locate controller near and visible to its respective hoisting machine.

3.3 WORKMANSHIP, INSTALLATION AND PROTECTION

A. Installations must be performed by Certified Elevator Mechanics and Apprentices to best possible industry standards. Details of the installation must be mechanically and electrically correct. Materials and equipment must be new and without imperfections.

B. Recesses, cutouts, slots, holes, patching, grouting, refinishing to accommodate installation of equipment must be included in the Contractor's work. All new holes in concrete must be core drilled.

C. Structural members must not be cut or altered. Work in place that is damaged or defaced must be restored equal to original new condition.

D. Finished work must be straight, plumb, level and square with smooth surfaces and lines. All machinery and equipment must be protected against dirt, water, or mechanical injury. At completion, all work must be thoroughly cleaned and delivered in perfect unblemished condition.

E. Sleeves for conduit and other small holes must project 51 mm (2 in.) above concrete slabs.

F. Hoist cables that are exposed to accidental contact in the machine room and pit must be completely enclosed with 16-gauge sheet metal or expanded metal guards.

G. Exposed gears, sprockets and sheaves must be guarded from accidental contact.

3.4 CLEANING

A. After completion of the installation and prior to final inspection, all equipment must be thoroughly cleaned of grease, oil, cement, plaster, dust and other debris.

B. Clean machine room and equipment.

C. Perform hoistway clean down.

D. Prior to final acceptance remove protective coverings from finished or ornamental surfaces. Clean and polish as required for type of material.

3.5 PAINTING AND FINISHING

A. All equipment, except specified as architectural finish, must be painted one coat of approved color, conforming to manufacturer's standard.

B. Hoist machine and motor must be painted manufacturer's standard finish and color.

C. Controller, sheave, car frame and platform, counterweight, beams, rails and buffers except their machined surfaces, cams, brackets and all other uncoated ferrous metal items must be painted one factory primer coat or approved equal.

D. Stencil or apply decal floor designations not less than 101 mm (4 in.) high on hoistway doors, fascia, or walls within door restrictor areas. The color of paint used must contrast with the color of the surfaces it is applied.

E. Elevator hoisting machine, controller, governor, main line switch/ shunt trip circuit breaker, safety plank and cross head of car must be identified by 101 mm (4 in.) high numerals and letters located as directed. Numerals must contrast with surrounding color and must be stenciled or decaled.

F. Hoistway Entrances of Passenger and Service Elevators:
   1. Door panels, except stainless steel surfaces, must be given rust resistant treatment and a factory finish of one coat of baked-on primer and one factory finish coat of baked-on enamel.
   2. 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, must be given one approved prime coat in the shop and one field coat of paint of approved color.

G. Elevator Cabs for Passenger and Service Elevators:
   1. Interior and exterior steel surfaces must be given rust resistant treatment before finish is applied.
   2. Interior steel surfaces must be factory finished with one coat of paint of approved color.
   3. Give exterior faces of car doors one finish coat of paint of approved color.

H. Hoistway Entrances of Freight Elevators:
   1. Metal surfaces of doors and frames must receive shop prime coat.
   2. Finish painting, after installation, must be one coat of paint of approved color.

I. Elevator Cabs for Freight Elevators:
   1. Give interior of cab one prime coat and a minimum of one coat of paint of approved color.
   2. Give exterior of cab one prime coat and one finish coat of paint of approved color.
   3. All surfaces of door frames, door panels and cab interior surfaces that become damaged or marred must be restored to original condition before final acceptance of work.

3.6 PRE-TESTS AND TESTS

A. Pre-test the elevators and related equipment in the presence of the Resident Engineer/Contracting Officer or authorized representative for proper operation before requesting final inspection. Conduct final inspection at other than normal working hours, if required by RE/CO.

1. The VA must obtain the services of an Independent Qualified Elevator Inspector, QEI-1 Certified Elevator Inspector. The QEI must utilize an Elevator Acceptance Inspection Form to record the results of inspection and all testing and to identify safety code and contract deficiencies. Specific values must be provided for all tests required by ASME A17.1, ASME A17.2 and contract documents. After completion of inspection and testing, the QEI must sign a copy of the completed form and provide it to the Contracting Officer. Within 14 days of the inspection, the QEI must also prepare a formal inspection report, including all test results and deficiencies. After successful completion of inspection and testing, the QEI must complete, sign and provide a certificate of compliance.
2. Government must furnish electric power including necessary current for starting, testing and operating machinery of each elevator.
3. Contractor must 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, stopwatch and a means of two-way communication.

B. Inspect workmanship, equipment furnished and installation for compliance with specification.

C. Balance Tests: The percent of counterbalance must 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 counterbalance does not conform to the specification, the amount of counterweight must be adjusted until conformance is reached.

D. Full-Load Run Test: Elevator must be tested for a period of one-hour continuous run with full contract load in the car. The test run must 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.

E. Speed Test: The actual speed of the elevator must be determined in both directions of travel with full contract load and no load in the elevator. Speed must 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 must be within three

G. (3) percent of specified rated speed. Full speed runs must be quiet and free from vibration and sway.

H. Temperature Rise Test: The temperature rise of the hoist motor must be determined during the full load test run. Temperatures must be measured using thermometers. Under these conditions, the temperature rise of the equipment must not exceed 50 degrees Centigrade above ambient temperature. Test must start when all machine room equipment is within five (5) degrees Centigrade of the ambient temperature. Other tests for heat run on motors must be performed as prescribed by the Institute of Electrical and Electronic Engineers.

I. Car Leveling Test: Elevator car leveling devices must 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 must 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 must automatically correct over travel as well as under travel and must maintain the car floor within plus or minus 3 mm (.125 in.) of level with the landing floor regardless of change in load.

J. Brake Test: The action of the brake must be prompt and a smooth stop must result in the up and down directions of travel with no load and rated load in the elevator. Down stopping must be tested with 125 percent of rated load in the elevator.

K. Insulation Resistance Test: The elevator's complete wiring system must be free from short circuits and ground faults and the insulation resistance of the system must be determined by use of megohm meter, at the discretion of the Elevator Inspector conducting the test.

L. Safety Devices: Car and counterweight safety devices must be tested.

M. Overload Devices: Test all overload current protection devices in the system at final inspection.

N. Limit Stops:

1. The position of the car when stopped by each of the normal limit switches with no load and with contract load in the car must be accurately measured.
2. Final position of the elevator relative to the terminal landings must be determined when the elevator has been stopped by the final

limits. The lower limit stop must be made with contract load in the elevator. Elevator must be operated at inspection speed for both tests. Normal limit stopping devices must be inoperative for the tests.

M. Oil Buffer Tests: These tests must 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 must be made at the lowest (leveling) speed. Final tests must be conducted at contract speed. Buffers must compress and return to the fully extended position without oil leakage.

N. Operating and Signal System: The elevator must be operated by the operating devices provided and the operation signals and automatic floor leveling must function in accordance with requirements specified. Starting, stopping and leveling must be smooth and comfortable without appreciable steps of acceleration or deceleration.

O. Performance of the Elevator supervisory system must be witnessed and approved by the elevator inspector and a representative of the Resident Engineer.

P. Evidence of malfunction in any tested system or parts of equipment that occurs during the testing must be corrected, repaired, or replaced at no additional cost to the Government and the test repeated.

Q. If equipment fails test requirements and a re-inspection is required, the Contractor must be responsible for the cost of re-inspection; salaries, transportation expenses and per-diem expenses incurred by the Elevator Inspector and RE/CO or authorized representative.

3.7 INSTRUCTION OF VA PERSONNEL

A. 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 must commence after completion of all work and at the time and place directed by the Resident Engineer/Contracting Officer or authorized representative.

B. Written instructions in triplicate relative to care, adjustments and operation of all equipment and accessories must be furnished and delivered to the RE/CO or authorized representative in independently bound folders. DVD recordings will also be acceptable. Written instructions must 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 with descriptive literature and identification and diagrams of equipment and parts. Information must also include electrical operation characteristics of all circuits, relays, timers, electronic devices and related characteristics for all rotating equipment.

C. 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".

3.8 GUARANTEE PERIOD OF SERVICE: MAINTENANCE SERVICE AND INSPECTIONS

A. Provide complete maintenance service and inspections on each elevator installation for one (1) year after completion and acceptance of each elevator in this specification by the Resident Engineer or Contracting Officer. This maintenance service must run concurrently with the warranty. Maintenance work must be performed by Certified Elevator Mechanics and Apprentices.

B. This contract covers full maintenance including emergency call back service, inspections and servicing the elevators listed in the schedule of elevators. The Elevator Contractor must perform the following:

1. Bi-weekly systematic examination of equipment.
2. During each maintenance visit the Elevator Contractor must clean, lubricate, adjust, repair and replace all parts as necessary to keep the equipment in like new condition and proper working order.
3. Furnishing all lubricant, cleaning materials, parts and tools necessary to perform the work required. Lubricants must be only those products recommended by the manufacturer of the equipment.
4. Equalizing tension, shorten or renew hoisting ropes.
5. As required, motors, controllers, selectors, leveling devices, operating devices, switches on cars and in hoistways, hoistway doors and car doors or gate operating device, interlock contacts, car and counterweight guides, car door sills, hangers for doors, car doors or gates, signal system, car safety device, governors, tension sheaves and buffers must be cleaned, lubricated and adjusted.
6. Guide rails, overhead sheaves and beams, counterweight frames and bottom of platforms must be cleaned every three months. Car tops and machine room floors must be cleaned monthly. Accumulated rubbish

must be removed from the pits monthly. A general cleaning of the entire installation including all machine room equipment and hoistway equipment must be accomplished quarterly. Cleaning supplies and vacuum cleaner must be furnished by the Contractor.

7. Maintain the performance standards set forth in this specification.
8. The operational system must be maintained to the standards specified hereinafter including any changes or adjustments required to meet varying conditions of hospital occupancy.
9. Maintain smooth starting, stopping, running and accurate leveling.

C. Maintenance service must not include the performance of work required because of improper use, accidents and negligence for which the Elevator Contractor is not directly responsible.

D. Provide 24-hour emergency call-back service that must consist of promptly responding to calls within two hours for emergency service should a shutdown or emergency develop between regular examinations. Overtime emergency call-back service must be limited to minor adjustments and repairs required to protect the immediate safety of persons and equipment in and about the elevator.

E. Service and emergency personnel must report to the Resident Engineer, Contracting Officer or authorized representative upon arrival at the hospital and again upon completion of the required work. A copy of the work ticket containing a complete description of the work performed must be given to the RE/CO or authorized representative.

F. The Elevator Contractor must maintain a logbook in the machine room. The log must list the date and time of all weekly examinations and all trouble calls. Each trouble call must be fully described including the nature of the call, necessary correction performed, or parts replaced.

G. Written “Maintenance Control Program” must be in place to maintain the equipment in compliance with ASME A17.1 Section 8.6.

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SECTION 14 24 00

HYDRAULIC ELEVATOR – NEW INSTALLATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the engineering, furnishing and installation of the complete hydraulic elevator system as described herein and as indicated on the Building 22 contract drawings.

B. Items listed in the singular apply to each elevator in this specification except where noted.

C. Service Elevator S1 must be oil hole-less hydraulic, microprocessor control system and power-operated car and hoistway doors. Elevator must be Class “A” loading rated as a minimum.

ELEVATOR SCHEDULE	
Elevator Number	S1
Overall Platform Size	W5’4” x D8’4”
Clear Inside Platform	W5’1” x D7’5”
Rated Load – kg (lb)	3500#
Contract Speed - m/s (fpm)	125fpm
Total Travel – m (ft)	Less than 15’
Floors Served	G & 1
Number of Openings	2
Entrance Type & Size	RH Two Speed Side Sliding W48” x 84”

1.2 RELATED WORK

A. Section 01 33 23 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.

B. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-rated construction.

C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.

D. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.

E. 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.

F. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.

G. Section 26 22 00, LOW-VOLTAGE TRANSFORMERS: Low voltage transformers.

H. Section 26 24 16, PANELBOARDS: Low voltage panelboards.

I. Section 26 51 00, INTERIOR LIGHTING: Fixture and ballast type for interior lighting

1.3 QUALIFICATIONS

A. Approval by the Contracting Officer is required for products and services of proposed manufacturers, suppliers, installers and must be contingent upon submission of certificates by the Contractor stating the following:

1. Elevator contractor is currently and regularly engaged in the installation of elevator equipment as one of his principal products.
2. Elevator contractor must have five (5) years of successful experience, trained supervisory personnel and facilities to install elevator equipment specified herein.
3. Elevator Mechanic (Installer) must 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 must be actively pursuing Certified Elevator Mechanic status. Certification must be submitted for all workers employed in this capacity.

B. Welding at the project site must be performed by certified welders who have previously qualified by test as prescribed in American Welding Society Publications AWS Dl.1 to perform the type of work required. Certificates must be submitted for all workers employed in this capacity. A welding or hot work permit is required for each day and must be obtained from the VAMC safety department. Request permit one day in advance.

C. Electrical work must be performed by a Licensed Master Electrician and Licensed Journeymen Electricians as requirements by NEC. Certificates must be submitted for all workers employed in this capacity.

D. Approval will not be given to elevator contractors and manufacturers who have established on prior projects, either government, municipal, or commercial, a record of 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.

E. Approval of Elevator Contractor’s equipment will be contingent upon their providing factory training, engineering and technical support, including all manuals, wiring diagrams and tools necessary for adjusting, maintenance, repair and testing of equipment to the VA for use by the VA’s designated Elevator Maintenance Service Provider.

F. Identifying an elevator maintenance service provider that must render services as directed by VA COR, together with certification that the quantity and quality of replacement parts stock is enough to warranty continued operation of the elevator installation.

G. Equipment within a group of hydraulic elevators must be the product of the same manufacturer.

H. The Contractor must 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.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification. Elevator installation must meet the requirements of the latest editions published and adopted by the United States Department of Veterans Affairs on the date this contract is signed.

B. Federal Specifications (Fed. Spec.):

J-C-30B - Cable and Wire, Electrical (Power, Fixed Installation)

J-C-580 – Cord, Flexible and Wire, Fixture

W-S-610 – Splice Connectors

W-C-596F - Connector, Plug, Electrical; Connector, Receptacle, Electrical

W-F-406E - Fittings for Cable, Power, Electrical and Conduit, Metal, Flexible

HH-I-558C - Insulation, Blankets, Thermal (Mineral Fiber, Industrial Type)

W-F-408E - Fittings for Conduit, Metal, Rigid (Thick- Wall and Thin-wall (EMT) Type)

RR-W-410 - Wire Rope and Strand

TT-E-489J - Enamel, Alkyd, Gloss, Low VOC Content

QQ-S-766 - Steel, Stainless and Heat Resisting, Alloys, Plate, Sheet and Strip

C. American Society of Mechanical Engineers (ASME):

A17.1 - Safety Code for Elevators and Escalators

A17.2 - Inspectors Manual for Electric Elevators and Escalators

D. National Fire Protection Association:

NFPA 13 - Standard for the Installation of Sprinkler Systems

NFPA 70 - National Electrical Code (NEC)

NFPA 72 - National Fire Alarm and Signaling Code

NFPA 101 - Life Safety Code

NFPA 252 - Fire Test of Door Assemblies

E. International Building Code (IBC)

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

A1008/A1008M-09 - Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High Strength Low-Alloy with Improved Formability

E1042-02 - Acoustically Absorptive Materials Applied by Trowel or Spray

G. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS):

SP-58 - Pipe Hangers and Supports

H. Society of Automotive Engineers, Inc. (SAE)

J517-91 - Hydraulic Hose, Standard

I. Gages:

For Sheet and Plate: U.S. Standard (USS)

For Wires: American Wire Gauge (AWG)

J. American Welding Society (AWS):

D1.1 - Structured Welding Code – Steel

K. National Electrical Manufacturers Association (NEMA):

LD-3 - High-Pressure Decorative Laminates

L. Underwriter's Laboratories (UL):

486A - Safety Wire Connectors for Copper Conductors

797 - Safety Electrical Metallic Tubing

M. Institute of Electrical and Electronic Engineers (IEEE)

N. Regulatory Standards:

Uniform Federal Accessibility Standards

Americans with Disabilities Act

VA Barrier Free Design Handbook H-18-13

O. National Elevator Industry, Inc.

NEII-1 Building Transportation Standards and Guidelines

1.5 SUBMITTALS

A. Submit in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.

B. Before execution of work, furnish information to evidence full compliance with contract requirements for proposed items. Such information must include, as required: Manufacturer's Name, Trade Names, Model or Catalog Number, Nameplate Data (size, capacity and rating) and corresponding specification reference (Federal or project specification number and paragraph). All submitted drawings and related elevator material must be forwarded to the Contracting Officer.

C. Shop Drawings:

1. Complete scaled and dimensioned layout in plan and section view showing the arrangement of equipment and all details of each elevator unit specified including:

a. Complete layout showing location of storage tank/pump assembly, controller, piping layout, outside diameter of cylinder/plunger assembly, size of car platform, car frame members and support assembly.

b. Car, guide rails, brackets, buffers and other components located in hoistway.

c. Rail bracket spacing and maximum vertical forces on guide rails in accordance with H-18-8 for Seismic Risk Zone 2 or greater.

d. Reaction at points of support and buffer impact loads.

e. Weight of principal parts.

f. Top and bottom clearances and over travel of the car.

g. Location of main line switch/shunt trip circuit breaker, switchboard panel, light switch and feeder extension points in the machine room.

2. Drawings of hoistway entrances and doors showing details of construction and method of fastening to the structural members of the building.
   a. If drywall construction is used to enclose hoistway, submit details of interface fastenings between entrance frames and drywall.
   b. Sill details including sill support.

D. Samples:
1. One each of stainless steel, 75 mm x 125 mm (3 in. x 5 in.).
2. One each of baked enamel, 75 mm x 125 mm (3 in. x 5 in.).
3. One each of color floor covering.
4. One each of protection pads, 75 mm x 125 mm (3 in. x 5 in.) if used.
5. One each car and hoistway Braille plate sample.
6. One each car and hall button sample.
7. One each car and hall lantern/position indicator sample.
8. One each wall and ceiling material finish sample.
9. One each car lighting sample.

E. Name of manufacturer, type or style designation and applicable data of the following equipment must be shown on the elevator layouts:
1. Storage tank/pump assembly.
2. Pump and motor, HP and RPM rating, Voltage, Starting and Full Load Ampere, Number of phases and Gallons per minute.
3. Controller.
4. Starters and Overload Current Protection Devices.
5. Car Safety Device; Rupture Valve and Manual Shut Off Valves.
6. Electric Door Operator; HP, RPM, Voltage and Ampere rating of motor.
7. Hoistway Door Interlocks.
8. Car Buffers; maximum and minimum rated load, maximum rated striking speed and stroke.
9. Cab Ventilation Unit; HP rating and CFM rating.

F. 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.

G. Complete dimensioned detail of vibration isolating foundations for storage tank/pump assembly.

H. Dimensioned drawings showing details of:

1. All signal and operating fixtures.
2. Car slide guides/roller guides.
3. Hoistway door tracks, hangers and sills.
4. Door operator, infrared curtain units.

I. Cut sheets or drawings showing details of controllers and supervisory panels.

J. Furnish certificates as required under: Paragraph "QUALIFICATIONS".

1.6 WIRING DIAGRAMS

A. Provide three complete sets of paper and one electronic set of 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/Contracting Officer or authorized representative.

B. In the event field modifications are necessary during installation, diagrams must be revised to include all corrections made prior to and during the final inspection. Corrected diagrams must be delivered to the Resident Engineer/Contracting Officer within 30 days of final acceptance.

C. Provide the following information relating to the specific type of microprocessor controls installed:

1. Owner's information manual, containing job specific data on major components, maintenance and adjustment.
2. System logic description.
3. Complete wiring diagrams needed for field troubleshooting, adjustment, repair and replacement of components. Diagrams must be base diagrams, containing all changes and additions made to the equipment during the design and construction period.
4. Changes made during the warranty period must 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.

1.7 PERFORMANCE STANDARDS

A. The elevators must meet the highest standards of the industry and specifically the following:

1. Contract speed is high speed in either direction of travel with rated capacity load in the elevator. Speed variation under all load

conditions, regardless of direction of travel, must not vary more than five (5) percent.

2. The controlled rate of change of acceleration and retardation of the car must not exceed 0.1G per ft/s/s and the maximum acceleration and retardation must not exceed 0.2G per ft/s/s.
3. Starting, stopping and leveling must be smooth and comfortable without appreciable steps of acceleration and deceleration.

B. The door operator must open the car door and hoistway door simultaneously at 2.5-feet per second and close at 1-foot per second.

C. Pressure: Fluid system components must be designed and factory tested for at least 500 psi operating pressure.

D. Floor level stopping accuracy must be within 3 mm (.125 in.) above or below the floor, regardless of load condition.

E. Noise and Vibration Isolation: All elevator equipment including their supports and fastenings to the building, must be mechanically and electrically isolated from the building structure to minimize objectionable noise and vibration transmission to car, building structure, or adjacent occupied areas of building.

F. Sound Isolation: Noise level relating to elevator equipment operation in machine room must not exceed 80 decibels. All db readings must be taken three (3) feet off the floor and three (3) feet from equipment.

G. Airborne Noise: Measured noise level of elevator equipment during operation must not exceed 50 decibels in elevator lobbies and 60 decibels inside car under any condition including door operation and car ventilation exhaust blower on its highest speed.

1.8 WARRANTY

A. Submit all labor and materials furnished regarding elevator system and installation to terms of "Warranty of Construction" articles of FAR clause 52.246-21. The One-Year Warranty and Guarantee Period of Service must commence and run concurrent after final inspection, completion of performance test and upon acceptance of each elevator.

B. 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 must be removed and a new device meeting all requirements must be installed as part of work until satisfactory operation of installation is obtained. Period of warranty must start anew for such parts from date of completion of

each new installation performed, in accordance with foregoing requirements.

1.9 POWER SUPPLY

A. For power supply in each machine room, see Specification 26 05 19, Electrical specifications and Electrical drawings.

B. Main Line Fused Disconnect Switch/Shunt Trip Circuit Breaker for each controller must be located inside the machine room at the strike side of the machine room door and lockable in the “Off” position.

C. Provide Surge Suppressors to protect the elevator equipment.

1.10 EMERGENCY POWER SUPPLY

A. Emergency power supply, its starting means, transfer switch for transfer of elevator supply from normal to emergency power, two pair of conductors in a conduit from an auxiliary contact on the transfer switch (open or close contacts as required by Elevator Controller Manufacturer) to terminals in the group elevator controller and other related work must be provided by the Electrical Contractor.

B. Upon loss of normal power supply there must be a delay before transferring to emergency power of 10 seconds minimum to 45 seconds maximum, the delay must be accomplished through an adjustable timing device.

C. Prior to the return of normal power an adjustable timed circuit must be activated that will cause all cars to remain at a floor if already there or stop and remain at the next floor if in flight. Actual transfer of power from emergency power to normal building power must take place after all cars are stopped at a floor with their doors open.

D. Car lighting circuits must be connected to the emergency power panel.

1.11 ELEVATOR MACHINE ROOM

A. Reuse existing machine room and meet the requirements of ASME A17.1, NFPA 70, NFPA 101 and IBC. The elevator drive machine and elevator controller must be in the same code approved machine room.

B. Locate the shunt trip breakers and machine room light switch to the lock side of the door inside the room.

C. Locate sprinkler pipes to provide seven (7) feet head clearance. Do not locate sprinkler heads, heat detectors and smoke detectors directly over elevator equipment.

1.12 HOISTWAY LIGHTING

A. Provide lighting with 3-way switches at the top and bottom of the hoistway accessible from elevator hoistway entrance prior to entering the pit or stepping onto the car top.

B. Lighting must illuminate top of elevator cab when it is at the top floor and the pit when at the bottom floor.

1.13 TOOL CABINET

A. Provide a metal parts/tool cabinet, having two shelves and hinged doors. Cabinet must be 1219 mm (48 in.) high, 762 mm (30 in.) wide and 457 mm (18 in.) deep.

1.14 WORK SCHEDULE

A. Before starting work submit a detailed work schedule for approval and arrange with COR sequence of procedure, means of access to premises, space for storage, use of approaches, corridors, stairways, elevators, location of temporary partitions, disposal of trash and recyclable materials. The COR must be notified twenty (20) calendar days, in writing, in advance of starting work on elevators. No work may begin on any elevator until all materials for that elevator have been delivered to the site and verified by the Contracting Officer and/or Contracting Officer’s Representative. The phasing of work on the elevators must be coordinated with the Contracting Officer and/or the Contracting Officer’s Representative.

1.15 SAFETY PRECAUTIONS

A. Building #_22__ will be occupied during execution of work. Work must be conducted in a manner to afford maximum protection of patients, public, employees, building and facilities to prevent unreasonable delay or interference with normal functioning of hospital activities.

B. Where an adjacent elevator is in operation, isolate the elevators from each other with suitable barriers between them, extending from the pit floor to bottom of secondary slab at top of hoistway, while work is in progress. Remove partition when work is completed.

C. Provide fire extinguishers that are readily available always.

D. It must be the obligation of the contractor to maintain a free and clear passageway in each elevator lobby. Parts and tools must be kept within the confines of entrance partitions. Trash and debris must be removed daily.

E. Provide fire rated partition during the modernization of elevators. Barrier must extend to the full height of the elevator entrance and must be dust and vapor proof with dust absorbing mats at access points.

1.16 REMOVAL OF MATERIALS AND EQUIPMENT

A. Material and equipment that are not specified to be reused or retained under contract must be removed daily from the site at the expense of the contractor. The contractor must receive title to all material and equipment not specified to be reused as of date of withdrawal from service. The government does not warranty condition of the material to which contractor must obtain title, nor must the government be liable for damage before or after title passes to contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Where stainless steel is specified, it must be corrosion resisting steel complying with Fed. Spec. QQ-S-766, Class 302 or 304, Condition A with Number 4 finish on exposed surfaces. Stainless steel must have the grain of belting in the direction of the longest dimension and surfaces must be smooth and without waves. During installation stainless steel surfaces must be protected with a suitable material.

B. Where cold rolled steel is specified, it must be low-carbon steel rolled to stretcher level standard flatness, complying with ASTM A109.

2.2 MANUFACTURED PRODUCTS

A. Materials, devices and equipment furnished must be of current production by manufacturers regularly engaged in the manufacture of such items. The elevator equipment, including controllers, door operators and supervisory system must be the product of manufacturers of established reputation, provided such items are capably engineered and produced under coordinated specifications to ensure compatibility with the total operating system.

B. Manufacturers of equipment assemblies which include components made by others must assume complete responsibility for the final assembled unit. Components must be compatible with each other and with the total assembly for the intended service.

C. Mixing of manufactures related to a single system or group of components must be identified in the submittals.

D. Key operated switches provide for this elevator modernization, must be provide four (4) keys for each individual switch or lock. Provide

different key tumblers for different switch and lock functions. Each key must have a tag bearing a stamped or etched legend identifying its purpose.

2.3 CONDUIT AND WIREWAY

A. Remove existing and provide new conduit and wireway. Install electrical conductors, except traveling cable connected to the elevator, in rigid zinc-coated steel or aluminum conduit, electrical metallic tubing or metal wireways. Rigid conduit smaller than .75 inch or electrical metallic tubing smaller than .50-inch electrical trade size must not be used. All raceways completely embedded in concrete slabs, walls, or floor fill must be rigid steel conduit. Wireway (duct) must be installed in the hoistway and to the controller and between similar apparatus in the elevator machine room. Fully protect self-supporting connections, where approved, from abrasion or other mechanical injury. Flexible metal conduit not less than .375-inch electrical trade size may be used, not exceeding 18 inches in length unsupported, for short connections between risers and limit switches, interlocks and for other applications permitted by NEC.

B. All conduits terminating in steel cabinets, junction boxes, wireways, switch boxes, outlet boxes and similar locations must have approved insulation bushings. Install a steel lock nut under the bushings if they are constructed completely of insulating materials. Protect the conductors at ends of conduits not terminating in steel cabinets or boxes by terminal fittings having an insulated opening for the conductors.

C. Rigid conduit and EMT fittings using set screws or indentations as a means of attachment must not be used.

D. Connect motors or other items subject to movement, vibration or removal to the conduit or EMT systems with flexible, steel conduits.

2.4 CONDUCTORS

A. Remove existing and provide new. Conductors must be stranded or solid coated annealed copper in accordance with Federal Specification J-C-30B for Type RHW or THW. Where 16 and 18 AWG are permitted by NEC, single conductors or multiple conductor cables in accordance with Federal Specification J-C-580 for Type TF may be used provided the insulation of single conductor cable and outer jacket of multiple conductor cable is flame retardant and moisture resistant. Multiple conductor cable

must have color or number coding for each conductor. Conductors for control boards must be in accordance with NEC. Joints or splices are not permitted in wiring except at outlets. Tap connectors may be used in wireways provided they meet all UL requirements.

B. Provide all conduit and wiring between machine room, hoistway and fixtures.

C. All wiring must test free from short circuits or ground faults. Insulation resistance between individual external conductors and between conductors and ground must be a minimum of one megohm.

D. Where size of conductors is not given, voltage and amperes must not exceed limits set by NEC.

E. Provide equipment grounding. Ground the conduits, supports, controller enclosure, motor, platform and car frame and all other non-current conducting metal enclosures for electrical equipment in accordance with NEC. The ground wires must be copper, green insulated and sized as required by NEC. Bond the grounding wires to all junction boxes, cabinets and wire raceways.

F. Terminal connections for all conductors used for external wiring between various items of elevator equipment must be solderless pressure wire connectors in accordance with Federal Specification W-S-610. The Elevator Contractor may, at his option, make these terminal connections on #10 gauge or smaller conductors with approved terminal eyelets set on the conductor with a special setting tool, or with an approved pressure type terminal block. Terminal blocks using pierce-through serrated washers are not acceptable.

2.5 TRAVELING CABLES

A. Remove existing and provide new flexible traveling cables conforming to the requirements of NEC. Traveling cables must run from the junction box on the car directly to the controller. Junction boxes on the car must 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. Terminal blocks must have permanent indelible identifying numbers for each connection. Cables must be securely anchored to avoid strain on individual terminal connections. Flame and moisture resistant outer covering must remain intact between junction boxes. Abrupt bending, twisting and distortion of the cables must not be permitted.

B. Provide spare conductors equal to 10 percent of the total number of conductors furnished, but not less than 5 spare conductors in each traveling cable.

C. Provide shielded wires for the auto dial telephone system within the traveling cable, five (5) pair shielded wires for card reader, one (1) RG-6 Ethernet cable for Wi-Fi, two (2) pair 14-gauge wires for 110 Volt power supply and wire for video display monitor if specified.

D. If traveling cables contact 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 may be installed from the hoistway suspension point to the elevator pit to prevent traveling cables from rubbing or chafing and securely fastened and tensioned to prevent buckling. Hardware cloth is not required when traveling cable is hung against a flat wall.

2.6 CONTROLLER AND SUPERVISORY PANEL

A. Remove existing and provide new UL/CSA Labeled Controller. Mount all assemblies, power supplies, chassis switches and relays on a steel frame in a NEMA Type 1 General Purpose Enclosure. Cabinet must be securely attached to the building structure.

B. Properly identify each device on all panels by name, letter, or standard symbol which must be neatly stencil painted or decaled in an indelible and legible manner. Identification markings must be coordinated with identical markings used on wiring diagrams. The ampere rating must be marked adjacent to all fuse holders. All spare conductors to controller and supervisory panel must be neatly formed, laced and identified.

C. Controller must be provided with wiring and components for additional future travel if required.

2.7 MICROPROCESSOR CONTROL SYSTEM

A. Provide a microprocessor control system with absolute position/speed feedback to control dispatching, signal functions, door operation and pump motor control. Complete details of the components and printed circuit boards, together with a complete operational description, must be submitted for approval. Provide closed transition SCR soft start.

B. Controller manufacturer must provide factory training, engineering and technical support, including all manuals, wiring diagrams and tools necessary for adjusting, maintenance, repair and testing of equipment

to the VA for use by the VA's designated Elevator Maintenance Service Provider.

C. Microprocessor dispatching system must evaluate building traffic demand including number of elevators in service, hall calls, car calls, elevator position, direction of travel, load in elevator, door status and select an elevator to answer hall calls for least possible passenger wait times.

D. Provide a low oil control feature that must shut off the motor and pump and return the elevator to the lowest landing. Upon reaching the lowest landing, doors will open automatically allowing passengers to leave the elevator and then doors must close. All control buttons, except the door open button, alarm bell button and the call for help button must be made ineffective.

2.8 MACHINE ROOM MONITOR

A. Provide a monitor in each machine room, separate monitors for each passenger elevator group and each service elevator group. Provide a separate keyboard for each monitor.

B. The monitor must contain indicators to provide the following information:

1. The floor where each elevator is currently located.
2. The direction that each elevator is currently traveling or is scheduled to travel.
3. The location and direction of currently registered hall calls.
4. Elevators that are currently out of service.
5. Elevators that are currently bypassing hall calls.
6. Elevators that are currently engaged in passenger transfers.
7. Operations program under which entire group is currently operating.
8. Zone divisions of the entire group.
9. Door positions.
10. Status indication for elevators on independent service, car top inspection, fire service, earthquake protection and activated stop switch and alarm bell.

C. The maintenance terminal must be suitable for all troubleshooting procedures related to the specific type of microprocessor installed on this project.

2.9 EMERGENCY POWER OPERATION

A. Emergency Rescue Operation:

Provide a power source to send the elevator to the lowest landing. After the elevator has leveled at the lowest landing, provide power to open the car and hoistway doors automatically. After a predetermined time, the doors must close. Power must stay applied to the door open button to reopen the doors from the inside of the elevator. The elevator must remain shut down at the bottom landing until normal power is restored. Install a sign on the controller indicating that power is applied to emergency rescue operator and door operator during loss of normal power.

2.10 FIREFIGHTER’S SERVICE

A. Provide Firefighter’s Service. All key switches must be barrel-key FEOK1.
   1. Main Floor:
   2. Alternate Floor:
   3. Verify main and alternate floors with RE/CO or authorized representative.

2.11 INDEPENDENT SERVICE

A. Provide an INDEPENDENT SERVICE a toggle switch in the service operating panel that must have its positions marked "ON" and "OFF". When the switch is in the "ON" position, the car must respond only to calls registered on its car dispatch buttons and must bypass all calls registered on landing push buttons. The car must start when a car call is registered, car call button or door close button is pressed, car and hoistway doors are closed and interlock circuits are made. When switch is returned to "OFF" position, normal service must be resumed.

2.12 MEDICAL EMERGENCY SERVICE – PATIENT CARE FACLITIES ONLY

A. Provisions must be made for calling elevator(s) to floors served by the elevator on an emergency basis, operating independently from the dispatch signals and landing call signals.
B. Install key switches in the floor landing push button fixture above the push buttons.
C. Provide a call registered light indicator adjacent to key switch. The key switch at the landings and in the car, must only be operable by authorized personnel with a key.
D. When key switch is activated at any floor, the call register light indicator must illuminate at the call floor and inside the elevator only. The elevator control system must instantly select an elevator to

respond to the medical emergency call. Immediately upon selection, all car calls must be cancelled. If car is traveling away from the medical emergency call, it must slow down and stop at the nearest floor, maintain closed doors, reverse direction and proceed nonstop to the medical emergency call floor. If the car is traveling toward the medical emergency call floor, it must proceed to that floor nonstop. If at the time of selection, it is slowing down for a stop, the car must stop, maintain doors closed and start immediately toward the medical emergency floor.

E. Arriving at the medical emergency floor, the car must remain with doors open for 60 seconds. After this interval has expired and the car has not been placed on medical emergency operation inside the car, the car must automatically return to normal service.

F. Provide an LED illuminated indicator light next to the Medical Emergency key switch the same size as the Fire Service indicator.
   1. Locate a “Medical Emergency” key switch above call buttons in the main car operating panel for selecting medical emergency service. Activation of the key switch will allow the car to accept a car call for any floor, close doors and proceed nonstop to the floor desired.
   2. After medical emergency call has been completed the elevator must return to normal operation after the key is removed.

G. In the center of the rear cab panel provide a back lighted "MEDICAL EMERGENCY" LED illuminated display that must flash on and off continuously when the car is assigned to this operation and until it is restored to normal service. "MEDICAL EMERGENCY" indicator must be a photographic negative type 1828 mm (72 in.) to center above the floor, 152 mm (6 in.) wide X 76 mm (3 in.) high, with 12.5 mm (.50 in.) high letters legible only when illuminated.

H. If the car being operated on “Independent Service”, the medical emergency service indicator lights in the car operating panel and rear wall must be illuminated, buzzer must sound and the “Audio Voice” system must direct the attendant to return the car to automatic operation.

I. If the car is out of service and unable to answer medical emergency calls, the call register light must not illuminate.

J. Each key switch must have its identity legible and indelible engraved in faceplates. All lettering must be 6 mm (.25 in.) high, filled with black paint.

K. When Phase I fire recall is activated, it must over-ride elevators on medical emergency service and return them to the main or alternate fire service recall floor. When the fire emergency floor has been identified the attendants may complete their medical emergency run on Phase II firefighter’s operation if life safety is not affected.

2.13 SEISMIC REQUIREMENTS

A. Meet the requirements VA Seismic Design Manual H-18-8.

2.14 PUMP, MOTOR AND VALVE ASSEMBLY

A. Provide new pump assembly for the control of the elevator self-contained in a unit fabricated of structural steel. The unit must consist of a hydraulic fluid pump, AC motor, oil control valves with down speed regulator, muffler, piping and fittings.

B. Enclose V-belt power unit on four open sides with not less than 16-gauge steel removable panel sections. Provide a 50 mm (2 in.) minimum, 100mm (4 in.) maximum air space between the top of the panels and bottom of tank. Line panels on the interior side with one-inch rigid acoustical insulation board. Install metal belt guard that can be removed with hand tools for servicing and inspection.

C. Control valves must be electronically controlled. Hydraulic fluid flow must be controlled to insure speed variation of not more than five (5) percent under all load conditions in either direction of travel. Locate the manual lowering valve, easily accessible, properly identified and not concealed within the storage tank. Mark the operating handle in red.

D. Pump must be designed for hydraulic elevator service, having a steady discharge without pulsation to give smooth and quiet operation. Pump output must be capable of lifting elevator car with rated capacity, with a speed variation of no more than five (5) percent between no load and full load. Hydraulic fluid by-pass must discharge directly into storage tank.

E. Provide motor specifically designed for elevator service, synchronous speed of 1800 RPM, not to exceed nameplate full load current by more than 10% and rated 120 starts per hour without exceeding a rise of 40 degrees C.

F. Provide isolation pads to prevent transmission of pump and motor vibration to the building.

G. Install blowout-proof, non-hammering, oil-hydraulic muffler in the hydraulic fluid supply pressure line near power unit in machine room. Design muffler to reduce to a minimum any pulsation or noises that may be transmitted through the hydraulic fluid into the hoistway.

2.15 HYDRAULIC SYSTEM

A. Construct the storage tank of sheet steel, welded construction and a steel cover with means for filling, a minimum one-inch protected vent opening and a valve drain connection. Tank must be sized to pass through machine room door as shown on drawings. Provide marked gauge to monitor hydraulic fluid level. Tank must be sized to hold volume of hydraulic fluid required to lift elevator to stop ring, plus a reserve of not less than ten gallons. Provide a baffle in the bottom of the tank to prevent entry of any sediment or foreign particles into hydraulic system. Baffle must also minimize aeration of hydraulic fluid. Permissible minimum hydraulic fluid level must be clearly indicated. Hydraulic fluid must be of good grade to assure free flow when cool and have minimum flash point of 380-400 degrees F. Provide initial supply of hydraulic fluid for operation of elevator.

1. Provide a means to maintain the fluid viscosity in the reservoir, pump and control valve at the manufacturer’s recommended operating temperature.
2. Provide a data plate on the tank frame indicating the characteristics of the hydraulic fluid used.

B. Provide and install connections between the storage tank, pump, muffler, operating valves and cylinder complete with necessary valves, pipe supports and fittings. Pipe must be minimum schedule 40 steel with threaded, flanged, or welded mechanical couplings. Size of pipe and couplings between cylinder and pumping unit must be such that fluid pressure loss is limited to 10 percent.

C. Hydraulic system working pressure must not exceed the Manufacturers recommended psi under any load condition. Do not subject valves, piping and fittings to working pressure greater than those recommended by the manufacturer.

D. Support all horizontal piping. Place hangers or supports within 300 mm (12 in.) on each side of every change of direction of pipeline and

space supports not over 304.8 cm (10 ft) apart. Secure vertical runs properly with iron clamps at sufficiently close intervals to carry weight of pipe and contents. Provide supports under pipe to floor.

1. Provide all piping from machine room to hoistway, including necessary supports or hangers. If remote piping is underground or in damp inaccessible areas, install hydraulic piping thru PVC sleeve.

E. Install pipe sleeves where pipes pass through walls or floors. After installation of piping, equip the sleeves with snug fitting inner liner of fire rated insulation.

F. Provide an automatic shut-off valve in the oil supply line at the cylinder inlets. Activate the automatic shut-off valve when there is more than a ten percent increase in high speed in the down direction. When activated, this device must immediately stop the descent of the elevator and hold the elevator. The exposed adjustments of the automatic shut-off valve must have their means of adjustment sealed after being set to their correct position.

G. Provide external tank shut-off valve to isolate hydraulic fluid during maintenance operations.

H. Provide shut-off valves in the pit near the cylinder and in the machine room capable of withstanding 150 percent of design operating pressure. Each manual valve must have an attached handle.

I. Provide oil-tight drip pan for assembled pumping unit, including storage tank. Pan must be not less than 16-gauge sheet steel, with one-inch sides.

J. Components of the hydraulic system must be factory certified to withstand pressure equal to twice the calculated working pressure.

2.16 HYDRAULIC PLUNGER ASSEMBLY

A. Provide new hole-less cylinder and plunger sized to lift gross load the height specified. Factory test the plunger assembly at a pressure equal to twice the calculated working pressure, for strength and to insure freedom from leakage. Provide bottom of cylinder head with internal guide bearing and top of cylinder head with removable packing gland. Victaulic type packing gland head must not be permitted.

1. Provide a bleeder valve located below the cylinder flange to release air or other gases from the system.
2. Equip cylinder with drip ring below the packing gland to collect leakage of hydraulic fluid.

3. Bolt the cylinder mounting brackets to footing channels that support the buffers.

B. Install a flexible tubing scavenger line with an electrically operated pump between the piston drip ring and oil storage tank. Scavenger line, pump and strainers must operate independently of hydraulic fluid pressure. Equip scavenger pump with a water float designed to prevent operation of the pump should the pit flood and designed to be manually reset. Secure pump and reservoir to the pit channels.

C. Plunger must be heavy seamless steel tubing, turned smooth and true to within plus or minus .38 mm (0.015 in.) tolerance and no diameter change greater than .07 mm (0.003 in.) per-inch of length. Where plunger is multi-piece construction, machine the joints to assure perfectly matching surfaces.

1. Secure plunger to underside of platform supporting beams with fastenings capable of supporting four times the weight of the plunger. The platen plate must incorporate piston to car vibration isolation.
2. Provide a stop ring welded or screwed to the bottom of plunger that must prevent the plunger from leaving its cylinder.
3. Isolate plunger head from the platen plate to prevent corrosion or electrolysis.
4. Protect plunger, repair or replace if gouged, nicked or scored.

2.18 CAR BUFFERS

A. Provide two new spring buffers for the elevator. Securely fasten buffers and supports to the pit channels and in the alignment with striker plates on elevator. Buffers must have a permanently attached metal plate indicating its stroke and load rating. Buffer anchorage must not puncture pit waterproofing. Reuse existing if possible.

B. Provide pipe stanchions and struts as required to properly support the buffer.

2.19 GUIDE RAILS, SUPPORTS AND FASTENINGS

A. Reuse existing. Clean, replace missing bolts and tighten as needed.

2.20 NORMAL AND FINAL TERMINAL STOPPING DEVICES

A. Mount new terminal slowdown switches and direction limit switches on the elevator or in hoistway to reduce speed and bring car to an automatic stop at the terminal landings.

1. Switches must function with any load up to and including 100 percent of rated elevator capacity at any speed obtained in normal operation.
2. Switches, when opened, must permit operation of elevator in reverse direction of travel.

B. Mount final terminal stopping switches in the hoistway.
1. Switches must be positively opened should the car travel beyond the terminal direction limit switches.
2. Switches must be independent of other stopping devices.
3. Switches, when opened, must remove power from pump motor and control valves preventing operation of car in either direction.

2.21 CROSSHEAD DATA PLATE AND CODE DATA PLATE

A. Permanently attach a non-corrosive metal Data Plate to car crosshead.

B. Permanently attach a Code Data Plate, in plain view, to the controller.

2.22 WORKMAN'S LIGHTS AND OUTLETS

A. Provide duplex GFCI protected type receptacles and lamp, with guards on top of elevator car and beneath platform.

B. The receptacles must be in accordance with Fed. Spec. W-C-596 for Type D7, 2-pole, 3-wire grounded type rated for 15 amperes and 125 volts.

2.23 CARTOP OPERATING DEVICE

A. Provide a new cartop operating device.

B. The device must be activated by a toggle switch mounted in the device. The switch must be clearly marked "INSPECTION" and "NORMAL" on the faceplate, with 6 mm (.25 in.) letters.

C. Movement of the elevator must be accomplished by the continuous pressure on a direction button and a safety button.

D. Provide an emergency stop switch, push to stop/pull to run.

E. Provide permanent identification for the operation of all components in the device.

F. The device must be permanently attached to the elevator crosshead on the side of the elevator nearest to the hoistway doors used for accessing the top of the car.

2.24 LEVELING DEVICE

A. Car must be equipped with a new two-way leveling device to automatically bring the car to within 3 mm (.125 in.) of exact level with the landing for which a stop is initiated regardless of load in car or direction of travel.

B. If the car stops short or travels beyond the floor, the leveling device, within its zone must automatically correct this condition and maintain the car within 3 mm (.125 in.) of level with the floor landing regardless of the load carried.

2.25 EMERGENCY STOP SWITCHES

A. Provide an emergency stop switch, push to stop/pull to run, for the top-of-car device, pit, machine spaces, service panel and firefighter’s control panel inside the elevator. Mount stop switches in the pit adjacent to pit access door, at top of the pit ladder 1219 mm (48 in.) above the bottom landing sill and 1219 mm (48 in.) above the pit floor adjacent to the pit ladder.

B. Each stop switch must be red in color and must have "STOP" and "RUN" positions legibly and indelibly identified.

2.26 MAIN CAR OPERATING PANEL

A. Provide new main car operating panel in the car enclosure on the front return panel for passenger/service elevators. The top floor car call push button must not be more than 1219 mm (48 in.) above the finished floor. “Vandal Resistant” car push buttons and indicator lights must be LED illuminated, round with a minimum diameter of 25 mm (1 in.). Each button must contain an integral registration LED white light which must illuminate upon registration of a call and must extinguish when that call is answered.

B. One-piece hinged front faceplate with edges beveled 15 degrees must have the firefighter’s service panel recessed into the upper section and the service operation panel recessed into the lower section fitted with hinged doors. Doors must have concealed hinges, be in the same front plane as the faceplate and fitted with cylinder type key operated locks. Secure the faceplate with stainless steel tamperproof screws.

C. All terminology and tactile symbols on the faceplate must be on square or rectangular plates recessed into the faceplate with its surface flush with the surface of the faceplate. Use 6 mm (.25 in.) letters to identify all devices in the faceplate. The handicapped markings with contrasting background must be 12.5 mm (.50 in.) high raised .075 mm (.030 in.) on the plate. Surface mounted plates are not acceptable.

D. The upper section must contain the following items in order listed from top to bottom:

1. Elevator number, 12.5 mm (.50 in.) high with black paint for contrast.
2. Capacity plate information with black paint for contrast with freight loading class and number of passengers allowed.
3. LED illuminated digital car position indicator with direction arrows.
4. Emergency car lighting system consisting of a rechargeable battery, charger, controls and LED illuminated light fixture. The system must automatically provide emergency light in the car upon failure or interruption of the normal car lighting service and function irrespective of the position of the light control switch in the car. The system must maintain a minimum illumination of 1.0 foot-candle when measured 1219 mm (48 in.) above the car floor and approximately 305 mm (12 in.) in front of the car operating panel, for not less than four (4) hours.
5. Firefighter’s Emergency Operation Panel must be 1650 mm (66 in.) minimum to 1828 mm (72 in.) maximum to the top of the panel above finished floor.
6. Firefighter’s Emergency Indicator Light must be round with a minimum diameter of 25 mm (1 in.).
7. Medical Emergency key switch marked “MEDICAL EMERGENCY” with two positions labeled “ON” and “OFF” and Medical Emergency Indicator Light located next to the key switch must be round with a minimum diameter of 25 mm (1 in.). Instruction for Medical Emergency operation must be adjacent to the key switch and light.
8. Key operated Independent Service Switch on the face of panel. (Delete if inside service panel).
9. Provide a Door Hold Button on the faceplate above the call buttons. It must have “DOOR HOLD” indelibly marked on the button. Button must light when activated. When activated, the door must stay open for a maximum of one minute. To override hold timer, push a car call button or door close button.
10. Provide round “Vandal Resistant” car push buttons and indicator lights, minimum diameter of 25 mm (1 in.) and LED illuminated, corresponding to the floors served. Car call buttons must be legibly and indelibly identified by a floor number, letter or symbol not

less than 12.5 mm (.50 in.) high in the face of the button or indicator.

11. Door Open and Door Close buttons must be located below the car call buttons. They must have “OPEN” and “CLOSE” legibly and indelibly identified by letters in the face of the respective button. The Door Open button must be located closest to the door jamb.
12. Red Emergency Alarm button that must be located below the car operating buttons. Mount the emergency alarm button not lower than 875 mm (35 in.) above the finished floor. It must be connected to audible signaling devices. Provide audible signaling devices including the necessary wiring.
13. Emergency Help push button must activate two-way communications by Auto Dial telephone system that is compatible with the VAMC’s telephone system. Help button must be LED white light illuminated and flash when call is acknowledged. Legibly and indelibly label the button “HELP” in the face of the button with 12.5 mm (.50 in.) high letters. Upon activation of the in car emergency phone system the video monitoring portion that is required by A17.1-2019 section 2.27 will also be activated.

E. The service operation panel, in the lower section must contain the following items:
   1. Light switch labeled “LIGHTS” for controlling interior car lighting with its two positions marked “ON” and “OFF”.
   2. Inspection switch that will disconnect normal operation and activate hoistway access switches at terminal landings. Switch must be labeled “ACCESS ENABLE” with its two positions marked “ON” and “OFF”.
   3. Three position switch labeled “FAN” with its positions marked “HIGH”, “LOW” and “OFF” for controlling car ventilating blower.
   4. Two position, spring return, toggle switch or push button to test the emergency light and alarm device. It must be labeled “TEST EMERGENCY LIGHT AND ALARM”.
   5. Independent service switch labeled “ON” AND “OFF”. (Delete if key switch on face of panel).

2.27 AUXILIARY CAR OPERATING PANEL

A. Provide an auxiliary car operating panel in the side wall of the elevator between the handrails immediately adjacent to the front

entrance column strike jamb. The auxiliary car operating panel must contain only those controls essential to passenger (public) operation. The auxiliary car operating panel faceplate must match the main car operating panel faceplate in material and general design. Secure the faceplate with stainless steel tamperproof screws.

1. Provide round “Vandal Resistant” car push buttons and indicator lights, minimum diameter 25 mm (1 in.) and LED illuminated corresponding to the floors served. Car buttons and indicator lights must be legibly and indelibly identified by a floor number, letter, or symbol not less than 12.5 mm (.50 in.) high in the face of the button or indicator light corresponding to the main car operating panel buttons or indicator light.
2. Door "OPEN" and door "CLOSE" buttons closest to the door jamb and mount the alarm button no lower than 889 mm (35 in.) above the finished floor. The Door Open button must be located closest to the door.
3. Cross-connect all buttons in the auxiliary car operating panels to their corresponding buttons in the main car operating panel. Registration of a car call must cause the corresponding button to illuminate in the main and auxiliary car operating panel.
4. Emergency Help push button must activate two-way communications by auto dial telephone that is compatible with the VAMC’s telephone system. Help button must be LED white light illuminated and flash when call is acknowledged. Legibly and indelibly label the button “HELP” in the face of the button with 12.5 mm (.50 in.) high letters.

B. All terminology and tactile symbols on the faceplate must be on square or rectangular plates recessed into the faceplate with its surface flush with the surface of the faceplate. Use 6 mm (.25 in.) letters to identify all devices in the faceplate. The tactile symbols with contrasting background must be 12.5 mm (0.5 in.) high raised .075 mm (.030 in.) on the plate. Surface mounted plates are not acceptable.

2.28 CAR POSITION INDICATOR

A. Provide an alpha-numeric digital car position indicator in the main car operating panel, consisting of numerals and arrows 63 mm (2.5 in.) high, to indicate position of car and direction of car travel. Locate

position indicator at the top of the main car operating panel, illuminated by light emitting diodes.

2.29 AUDIO VOICE SYSTEM

A. Provide digitized audio voice system activated by stopping at a floor. Audio voice must announce floor designations, direction of travel and special announcements. The voice announcement system must be a natural sounding human voice that receives messages and must comply with ADA requirements for audible car position indicators. The voice announcer must have two separate volume controls, one for the floor designations and direction of travel and another for special announcements. The voice announcer must have a full range loudspeaker, located on top of the cab. The audio voice unit must contain the number of ports necessary to accommodate the number of floors, direction messages and special announcements. Install voice announcer per manufacturer’s recommendations and instructions. The voice system must be the product of a manufacturer of established reputation. Provide manufacturer literature and list of voice messages.

1. Fire Service Message.
2. “Please do not block doors”.
3. Provide special messages as directed by COR.

2.30 AUTO DIAL TELEPHONE SYSTEM

A. Provide a complete, ADA compliant, auto dial/video communication system that is compatible with the VAMC’s telephone system.

B. Two-way communication device shall be in full compliance with ASME A17.1 Rule 2.27.1.1 (2019) or later editions.

2.31 CORRIDOR OPERATING DEVICES

A. Provide new corridor operating device faceplates from not less than 3 mm (.125 in.) thick flat stainless steel with all edges beveled 15 degrees.

B. Corridor push button faceplates must be sized to cover existing openings in the walls. The centerline of the landing push buttons must be 1067 mm (42 in.) above the corridor floor.

C. Elevator Corridor Call Station Pictograph must be engraved in the faceplate.

D. Fasten all car and corridor operating device and signal device faceplates with stainless steel tamperproof screws.

E. All terminology and tactile symbols on the faceplate must be raised .030 inch with contrasting background, on square or rectangular plates recessed into the faceplate with its surface flush with the surface of the faceplate. The handicapped markings with contrasting background must be 12.5 mm (0.5 in.) high raised .075 mm (.030 in.) on the plate, square or rectangular. Use 6 mm (.25 in.) letters to identify all other devices in the faceplate. Surface mounted plates are not acceptable.

F. Provide one riser of landing call buttons for the elevator as shown on contract drawings.

G. “Vandal Resistant” hall buttons and indicator lights must be LED illuminated upon registration of a call and shall extinguish when that call is answered.

H. The direction of each button must be legibly and indelibly identified by arrows not less than 12.5 mm (.50 in.) high in the face of each button. Provide a corresponding Braille plate on the left side of each button.

I. Hall call buttons must not re-open the doors while the car and hoistway doors are closing at that floor, the call must be registered for the next available elevator. Calls registered must be canceled if closing doors are re-opened by means of "DOOR OPEN" button or infrared curtain unit.

J. Provide a fire service recall key switch and indicator light, fire recall instruction, communication failure light, audible enunciator and reset key switch in the fixture at the designated main floor.

K. Remove old fixtures, repair and refinish walls.

L. Submit design of hall pushbutton fixtures for approval.

2.32 CORRIDOR ARRIVAL LANTERN/POSITION INDICATOR

A. Provide new combination corridor lantern/position indicator digital display mounted over the hoistway entrances at each floor in healthcare facilities. For non-healthcare facilities provide combination fixtures only at main and alternate fire recall floors. Provide each terminal landing with "UP" or "DOWN", minimum 63 mm (2.5 in.) high digital arrow lanterns and each intermediate landing with "UP" and "DOWN" digital arrow lanterns. Each lens must be LED illuminated of proper intensity, so shielded to illuminate individual lens only. The lenses in each lantern must be illuminated green to indicate "UP" travel and red to indicate "DOWN" travel. Lanterns must signal in advance of car arrival

at the landing indicating the direction of travel. Corridor lanterns must not be illuminated when a car passes a floor without stopping. Each lantern must be equipped with an audible electronic chime which must sound once for "UPWARD" bound car and twice for "DOWNWARD" bound car. Audible signal must not sound when a car passes the floor without stopping. Provide adjustable sound level on audible signal. Car riding lanterns are not acceptable.

B. Install alpha-numeric digital position indicator between the arrival lanterns. Indicator faceplate must be stainless steel. Numerals must be not less than 63 mm (2.5 in.) high with direction arrows. Cover plates must be readily removable for re-lamping. The appropriate direction arrow must be illuminated during entire travel of car in corresponding direction.

C. Remove old fixtures, repair and refinish walls.

2.33 HOISTWAY ACCESS

A. Provide new n hoistway access switches for elevator at top terminal landing to permit access to top of car and at bottom terminal landing to permit access to pit. Elevators with side slide doors, mount the access key switch 182.9 cm (6 ft) above the corridor floor in the wall next to the strike jamb.

B. Exposed portion of each access switch or its faceplate must have legible, indelible legends to indicate "UP", "DOWN" and "OFF" positions.

C. Each access switch must be a constant pressure cylinder type lock having not less than five pins or five stainless steel disc combination with key removable only when switch is in the "OFF" position.

D. Lock must not be operable by any other key which will operate any other lock or device used for any other purpose at the VA Medical Center.

E. Arrange the hoistway switch to initiate and maintain movement of the car. When the elevator is operated in the down direction from the top terminal landing, limit the zone of travel to a distance not greater than the top of the car crosshead level with the top floor. Submit design and location of access switches for approval.

F. Provide emergency access for all hoistway entrances, keyways for passenger and service elevators.

2.34 HOISTWAY ENTRANCES: PASSENGER/SERVICE ELEVATORS

A. Provide new stainless-steel entrance frames.

B. Provide new hoistway sills, hanger supports, strut angles, fascia plates and toe guards.

C. Provide new dust covers.

C. Provide new stainless steel hoistway doors. Door panels must be flush hollow metal construction, not less than 32 mm (1.25 in.) thick, consisting of one continuous piece 16-gauge stainless steel on corridor side wrapped around the leading edge. Separate two plates by a sound-deadening material and reinforce by steel shapes welded to the plates at frequent intervals. Reinforce panels as required for installation of hangers, power-operating and door-opening devices. Top and bottom of door panels must have continuous stiffener channels welded in place. Reinforcement of the door panels must be a minimum of 1.0 mm (0.04 in.) in thickness and of the hat section type.

E. Hang doors on two-point suspension hangers having sealed ball-bearing sheaves not less than 76 mm (3 in.) in diameter, with non-metallic sound-reducing tires. Equip hangers with adjustable ball-bearing rollers to take upward thrust of panels. Provide two removable non-metallic door gibs of approved material and a separate fire gib at the bottom of each door panel. Gibs must be replaceable without removing of door panel. One door panel for each entrance must bear a BOCA label, Underwriters' label, or other labels may be furnished provided they are based on fire test reports and factory inspection procedures acceptable to the COR. Fasten stainless steel sight guard of 14-gauge metal, extending full height of panel, to leading edge of fast speed panel of two-speed doors.

F. Provide new hardware, tracks, gibs, separate fire gibs, door rollers, door locks, drive roller assemblies and sill mounted closers or spirators.

G. Provide new braille plates on both sides of door frame entrances located 1523 mm (60 in.) to center above finished floor. Replace damaged or missing Braille plates.

H. Provide unique car number on every elevator entrance at designated main fire service floor level, minimum 76 mm (3 in.) in height.

I. Equip each hoistway entrance with new electrical/mechanical interlock, functioning as hoistway unit system, to prevent operation of elevator

until all hoistway doors are locked in the closed position unless car is operating in the leveling zone or hoistway access switch is used.

J. Wiring installed from the hoistway riser to each door interlock must be NEC type SF-2 or equivalent.

2.35 CAR GUIDES

A. Provide new adjustable roller guides, each assembled on a substantial metal base, to permit individual alignment to the guide rails.

B. Each guide must consisting of not less than three (3) wheels, each with a durable, resilient oil-resistant material tire rotating on ball bearings having sealed-in lubrication. Assemble rollers on a substantial metal base and mount to provide continuous spring pressure contact of all wheels with the corresponding rail surfaces under all conditions of loading and operation. Secure the roller guides at top and bottom on each side of car frame and counterweight frame. All mounting bolts must be fitted with nuts, flat washers, split lock washers and if required, beveled washers.

C. Provide sheet metal guards to protect rollers on top of car and counterweight.

D. Minimum diameter of car rollers must be 150 mm (6 in.). The entire elevator car must be properly balanced to equalize pressure on all guide rollers. Cars must be balanced in post-wise and front-to-back directions. Test for this balanced condition must be witnessed at time of final inspection.

E. Equip car with an auxiliary guiding device for each guide that must prevent the car from leaving the rails if the normal guides fail. These auxiliary guides must not, during normal operation, touch the guiding surfaces of the rails. Fabricate the auxiliary guides from hot rolled steel plate and mount between the normal guide shoes and the car frames. The auxiliary guides may be an extension of the normal guide shoe mounting plate if that plate is fabricated from hot rolled steel. The portion of the auxiliary guide which must contacts the rail guiding surfaces in the event of loss of the normal guides must be lined with an approved bearing material to minimize damage to the rail guiding surfaces.

2.36 CAR FRAME: PASSENGER/SERVICE ELEVATORS

A. Car frame must be constructed of channel stiles, crosshead, gussets and braces, securely bolted and/or welded. The entire assembly must be

constructed to withstand unequal loading of platform. Car frame members must be constructed to relieve the car enclosure of all strains.

2.37 CAR PLATFORM: PASSENGER/SERVICE ELEVATORS

A. The platform must be designed to withstand the forces developed under the loading class specified. Provide car entrance with new stainless-steel sill with machined or extruded guide grooves and recessed- for platform guard. Cover underside and all exposed edges of wood filled platform with sheet metal of not less than 27-gauge, with all exposed joints and edges folded under. Fire resistant paint is not acceptable. Platform must have flexible composition flooring not less than 3 mm (.125 in.) thick. Adhesive material must be type recommended by manufacturer of flooring. Lay flooring flush with threshold plate and base.

B. Provide a platform guard (toe guard) of not less than 12-guage sheet-steel on the entrance side, extend 76 mm (3 in.) beyond each side of entrance jamb. Securely brace platform guard to car platform and bevel bottom edge at a 60-75-degree angle from horizontal. Install platform in the hoistway, so that the clearance between front edge and landing threshold must not exceed 32 mm (1.25 in.).

C. Provide new isolation pads between the platform and platform frame, where needed. Use approved rubber pads or other approved material.

D. Provide adjustable diagonal brace rods to hold platform firmly within car suspension frame.

E. Balance car front to back and side to side. Provide balancing frame and weights, properly located, to achieve the required true balance.

F. Provide a bonding wire between frame and platform.

2.38 CAR ENCLOSURE: PASSENGER/SERVICE ELEVATORS

A. Car enclosure must have a dome height inside the cab of 243.8 cm (8 ft).

B. Securely fasten car enclosure to platform by through bolts located at intervals of not more than 457 mm (18 in.) running through an angle at the base of panels to underside of platform.

C. Front return wall panel, entrance columns, entrance head-jamb and transom must be 14-gauge stainless steel. Transom must be full width of cab. Side and rear walls must be constructed of 14-gauge cold rolled steel. Coat exterior of walls with mastic sound insulation material approximately 2.5 mm (.10 in.) thick followed by a prime coat of paint.

E. Side and rear walls of service elevators, up to the center line of the top handrail, must be covered with stainless steel. Submit a method of fastening panels to steel walls.

F. Construct canopy of not less than 12-gauge steel.

G. Provide car top railings.

H. Provide a hinged top emergency exit cover. Exit must be unobstructed when open and must have mechanical stops on the cover. Provide an exit switch to prevent operation of the elevator when the emergency exit is open.

I. Provide duplex, GFCI protected receptacle in car. Locate flush-mounted receptacle on the centerline of the main car operating panel, 150 mm (6 in.) above the car floor.

J. Lighting for passenger/service elevators:

1. Provide stainless steel hanging ceiling frame. Construct frame of 3.125 mm (.125 in.) thick x 38 mm (1.50 in.) wide x 38 mm (1.50 in.) high “T” and “L” sections, divide ceiling into six panels.
2. Provide LED illuminated car light fixtures above the ceiling panels. Maintain a minimum light level of 50-foot candles at 914 mm (36 in.) above the finished floor.

K. Optional lighting for service elevators:

1. Provide car with indirect LED lamps mounted front to rear in lighting coves along each side of the cab ceiling, no hanging ceiling.
2. Equip the lighting cove with asymmetrical reflectors having specular finish. Maintain a minimum light level of 50-foot candles 914 mm (36 in.) above finished floor at the car operating panels.
3. Enclose the entire vertical space between the light trough outer edge and the cab canopy with approved opaque white or clear lumicite sheeting. Lumicite sheeting must be removable for cleaning and re-lamping.

L. Provide a blower unit arranged to exhaust through an opening in the canopy. Provide a stainless or chrome plated fan grill on the interior side of the opening. Provide screening over intake and exhaust end of blower. Provide 2-speed fan, with rated air displacement of 250 cfm and 400 cfm at respective speeds. Mount fan on top of car with rubber isolation to prevent transmission of vibration to car structure. Provide a 3-position switch to control the unit in the service panel.

M. Provide car enclosure with two sets of handrails with centerlines 7’62 mm and 1067 mm (30 in. and 42 in.) above the car floor.
   1. Locate handrails 38 mm (1.50 in.) from cab wall. Install handrails on side and rear walls. Conceal all handrail fastenings. Handrails must be removable from inside the car enclosure.
   2. Provide service elevators with flat stock handrails with the ends at the entrance turned back to the wall.

N. Provide passenger car with single speed center opening horizontal sliding doors and service car with two-speed side opening horizontal sliding doors constructed the same as hoistway doors.

O. Provide one set of protective pads for service elevator of sufficient length to completely cover two sides, rear walls and front return of cab interior. Pads must consist of a minimum of 6 mm (.25 in.) thick glass fiber insulation securely sewn between flame resistant vinyl coated coverings. Color of the covering must be approved by the Contracting Officer. Provide stainless steel pad buttons or hooks, spaced at intervals of not more than 457 mm (18 in.) to adequately support pads.

2.39 POWER DOOR OPERATORS: PASSENGER/SERVICE ELEVATORS

A. Provide a new high-speed heavy-duty door operator to automatically open the car and hoistway doors simultaneously when the car is level with the floor and automatically close the doors simultaneously at the expiration of the door-open time. Provide solid-state door control with closed loop circuitry to constantly monitor and automatically adjust door operation based upon velocity, position and motor current. Motor must be of the high-internal resistance type, capable of withstanding high currents resulting from stall without damage to the motor. The door operator must open the car door and hoistway door simultaneously, at a speed of 76.2 cm (2.5 ft) per second. The closing speed of the doors must be 30.5 cm (1 ft) per second. A reversal of direction of the doors from the closing to opening operation, whether initiated by obstruction of the infrared curtain or the door "OPEN" button, must be accomplished within 38 mm (1.5 in.) maximum of door movement. Emphasis is placed on obtaining quiet interlock and door operation; smooth, fast, dynamic braking for door reversals, stopping of the door reversal and stopping of the doors at extremes of travel. Construct all levers

and drive arms operating the doors, of heavy steel members and all pivot points must have ball or roller bearings.

B. Car and hoistway doors must be manually operable (open only) in an emergency without disconnecting the power door operating equipment unless the car is outside the unlocking zone.
   1. It must not be possible for the doors to open by power unless the elevator is within the leveling zone.
   2. Provide infrared curtain unit. The device must cause the car and hoistway doors to reverse automatically to the fully open position should the unit be actuated while the doors are closing. Unit must function when the doors are not closed, irrespective of all other operating features except firefighter’s service.

C. Should the doors be prevented from closing for more than a predetermined adjustable interval of 20 to 60 seconds by operation of the curtain unit, the doors must stay open, the audio voice message and a buzzer located on the car must sound only on automatic operation. Do not provide door nudging.
   1. If an obstruction of the doors should not activate the photo-electric door control device and prevent the doors from closing for more than a predetermined adjustable interval of 15 to 30 seconds, the doors must reverse to the fully open position and remain open until the “Door Close” button re-establishes the closing cycle.

D. Provide door "OPEN" and "CLOSE" buttons. When the door "OPEN" button is pressed and held, the doors, if in the open position, must remain open and if the doors are closing, they must stop, reverse and re-open. Momentary pressure of the door "CLOSE" button must initiate the closing of the doors prior to the expiration of the normal door open time.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine work of other trades on which the work of this section depends. Report defects to the COR in writing which may affect the work of the elevator contractor.

B. Examine elevator hoistway openings for plumb, level, in line and that elevator pit is proper size, waterproofed and drained with necessary access door and ladder.

C. Examine machine room for proper illumination, heating, ventilation, electrical equipment and beams are correctly located complete with access stairs and door.

D. Before fabrication, take necessary job site measurements and verify where work is governed by other trades. Check measurement of space for equipment and means of access for installation and operation. Obtain dimensions from site for preparation of shop drawings.

E. Work required prior to the completion of the elevator installation:

1. Supply of electric feeder wires to the terminals of the elevator control panel, including circuit breaker.
2. Provide light and GFCI outlets in the elevator pit and machine room.
3. Furnish electric power for testing and adjusting elevator equipment.
4. Furnish circuit breaker panel in machine room for car and hoistway lights and receptacles.
5. Supply power for cab lighting and ventilation from an emergency power panel specified in Division 26, ELECTRICAL.
6. Machine room enclosed and protected from moisture, with self-closing, self-locking door and access stairs.
7. Provide fire extinguisher in machine room.

3.2 ARRANGEMENT OF EQUIPMENT

A. Arrange equipment in machine room so that major equipment components can be removed for repair or replacement without dismantling or removing other equipment in the same machine room. Locate controller near and visible to its respective hoisting machine.

3.3 WORKMANSHIP AND PROTECTION

A. Installations must be performed by Certified Elevator Mechanics and Apprentices to best possible industry standards. Details of the installation must be mechanically and electrically correct. Materials and equipment must be new and without imperfections.

B. Recesses, cutouts, slots, holes, patching, grouting, refinishing to accommodate installation of equipment must be included in the Contractor's work. All new holes in concrete must be core drilled.

C. Structural members must not be cut or altered. Work in place that is damaged or defaced must be restored equal to original new condition.

D. Finished work must be straight, plumb, level and square with smooth surfaces and lines. All machinery and equipment must be protected

against dirt, water, or mechanical injury. At completion, all work must be thoroughly cleaned and delivered in perfect unblemished condition.

E. Sleeves for conduit and other small holes must project 51 mm (2 in.) above concrete slabs.

F. Exposed gears, sprockets and sheaves must be guarded from accidental contact.

3.4 CLEANING

A. After completion of installation and prior to final inspection, all equipment must be thoroughly cleaned of grease, oil, cement, plaster, dust and other debris.

B. Clean machine room and equipment.

C. Perform hoistway clean down.

D. Prior to final acceptance remove protective coverings from finished or ornamental surfaces. Clean and polish as required for type of material.

3.5 PAINTING AND FINISHING

A. All equipment, except specified as architectural finish, must be painted one coat of approved color, conforming to manufacturer's standard.

B. Pump Unit Assembly must be factory painted with manufacturer's standard finish and color.

C. Controller, car frame and platform, rails and buffers except their machined surfaces, cams, brackets and all other uncoated ferrous metal items must be painted one factory primer coat or approved equal.

D. Stencil or apply decal floor designations not less than 100 mm (4 in.) high on hoistway doors, fascia or walls within door restrictor areas. The color of paint used must contrast with the color of the surfaces to which it is applied.

E. Elevator pump/motor machine, controller, main line switch/shunt trip circuit breaker, bolster channel and cross head of car must be identified by 100 mm (4 in.) high numerals and letters located as directed. Numerals must contrast with surrounding color and must be stenciled or decaled.

F. Hoistway Entrances of Passenger and Service Elevators:

1. Door panels must be given rust resistant treatment and a factory finish of one coat of baked-on primer and one factory finish coat of baked-on enamel.

2. 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) must be given one approved prime coat in the shop and one field coat of paint of approved color.

H. Elevator Cabs for Passenger and Service Elevators:

1. Interior and exterior steel surfaces must be given rust resistant treatment before finish is applied.
2. Interior steel surfaces must be factory finished with one coat of paint of approved color.
3. Give exterior faces of car doors one finish coat of paint of approved color.

3.6 PRE-TESTS AND TESTS

A. Pre-test the elevators and related equipment in the presence of the Contracting Officer or his authorized representative for proper operation before requesting final inspection. Conduct final inspection at other than normal working hours, if required by Contracting Officer.

1. The VA must obtain the services of an Independent Qualified Elevator Inspector, ANSI/ASME QEI-1 Certified, that must witness all tests. The QEI must utilize an Elevator Acceptance Inspection Form to record the results of inspection and all testing and to identify safety code and contract deficiencies. Specific values must be provided for all tests required by ASME A17.1, ASME A17.2 and contract documents. After completion of inspection and testing, the QEI must sign a copy of the completed form and provide it to the Contracting Officer. Within 14 days of the inspection, the QEI must also prepare a formal inspection report, including all test results and deficiencies. After successful completion of inspection and testing, the QEI will complete, sign and provide a certificate of compliance provide by the VA.
2. Government must furnish electric power including necessary current for starting, testing and operating machinery of each elevator.
3. Contractor must 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, stopwatch and a means of two-way communication.

B. Inspection of workmanship, equipment furnished and installation for compliance with specification.

C. Full-Load Run Test: Elevators must be tested for a period of one-hour continuous run with full contract load in the car. The test run must consist of the elevator stopping at all floors, in either direction of travel, for not less than five or more than ten seconds per floor.

D. Speed Test: The actual speed of the elevator must be determined in both directions of travel with full contract load and no load in the elevator. Speed must be determined by certified tachometer. The actual measured speed of the elevator with all loads in either direction must be within five (5) percent of specified rated speed. Full speed runs must be quiet and free from vibration and sway.

E. Temperature Rise Test: The temperature rise of the pump motor must be determined during the full load test run. Temperatures must be measured using thermometers. Under these conditions, the temperature rise of the equipment must not exceed 50 degrees Centigrade above ambient temperature. Test must start when all machine room equipment is within 5 degrees Centigrade of the ambient temperature. Other tests for heat runs on motors must be performed as prescribed by the Institute of Electrical and Electronic Engineers.

F. Car Leveling Test: Elevator car leveling devices must 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 must be within plus or minus 3 mm (.125 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 must automatically correct over travel as well as under travel and must maintain the car floor within plus or minus 3 mm (.125 in.) of level with the landing floor regardless of change in load.

G. Insulation Resistance Test: The elevator's complete wiring system must be free from short circuits and ground faults and the insulation resistance of the system must be determined by use of megohm meter, at the discretion of the Elevator Inspector conducting the test.

H. Overload Devices: Test all overload current protection devices in the system at final inspection.

I. Limit Stops:
   1. The position of the car when stopped by each of the normal limit stops with no load and with contract load in the car must be accurately measured.
   2. Final position of the elevator relative to the terminal landings must be determined when the elevator has been stopped by the final limits. The lower limit stop must be made with contract load in the elevator. Elevator must be operated at inspection speed for both tests. Normal limit stopping devices must be inoperative for the tests.

J. 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.

K. Test automatic shut-off valve for proper operation.

L. Operating and Signal System: The elevator must be operated by the operating devices provided and the operation signals and automatic floor leveling must function in accordance with requirements specified. Starting, stopping and leveling must be smooth and comfortable without appreciable steps of acceleration or deceleration.

M. Performance of the Elevator supervisory system must be witnessed and approved by the COR.

N. Evidence of malfunction in any tested system or parts of equipment that occurs during the testing must be corrected, repaired, or replaced at no additional cost to the Government and the test repeated.

O. If equipment fails test requirements and a re-inspection is required, the Contractor must be responsible for the cost of re-inspection; salaries, transportation expenses and per-diem expenses incurred by the representative of the Contracting Officer.

3.7 INSTRUCTION TO VA PERSONNEL

A. 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 workday. Instruction must commence after completion of all work and at the time and place directed by the Resident Engineer/Contract Officer or authorized representative.

B. Written instructions in triplicate relative to care, adjustments and operation of all equipment and accessories must be furnished and delivered to the RE/CO or authorized representative in independently

bound folders. DVD recordings will also be acceptable. Written instructions must 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 with descriptive literature and identification and diagrammatic cuts of equipment and parts. Information must also include electrical operation characteristics of all circuits, relays, timers and electronic devices, as well as rpm values and related characteristics for all rotating equipment.

C. 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".

3.8 ELEVATOR GUARANTEE PERIOD OF SERVICE: MAINTENANCE SERVICE AND INSPECTIONS

A. Provide complete maintenance service and inspections during the modernization period for all elevators and on each elevator for one (1) year after completion and acceptance of each elevator in this specification by the Resident Engineer or Contracting Officer. This maintenance service must run concurrently with the warranty. Maintenance work must be performed by Certified Elevator Mechanics and Apprentices.

B. This contract will cover full maintenance including emergency call back service, inspections and servicing the elevators listed in the schedule of elevator. The Elevator Contractor must be required to perform the following:

1. Monthly systematic examination of equipment.
2. During each maintenance visit the Elevator Contractor must clean, lubricate, adjust, repair and replace all parts as necessary to keep the equipment in first class condition and proper working order.
3. Furnishing all lubricant, cleaning materials, parts and tools necessary to perform the work required. Lubricants must be only those products recommended by the manufacturer of the equipment.
4. As required, motors, controllers, selectors, leveling devices, operating devices, switches on cars and in hoistways, hoistway doors and car doors or gate operating device, interlock contacts, guide shoes, guide rails, car door sills, hangers for doors, car doors or gates and signal system must be cleaned, lubricated and adjusted.

5. Guide rails and bottom of platforms must be cleaned every three months. Car tops and machine room floors must be cleaned monthly. Accumulated rubbish must be removed from the pits monthly. A general cleaning of the entire installation including all machine room equipment and hoistway equipment must be accomplished quarterly. Cleaning supplies and vacuum cleaner must be furnished by the Contractor.
6. Maintain the performance standards set forth in this specification.
7. The operational system must be maintained to the standards specified hereinafter including any changes or adjustments required to meet varying conditions of hospital occupancy.
8. Maintain smooth starting and stopping and accurate leveling always.

C. Maintenance service must not include the performance of work required because of improper use, accidents and negligence for which the Elevator Contractor is not directly responsible.

D. Provide 24-hour emergency call-back service that must consist of promptly responding to calls within two hours for emergency service should a shutdown or emergency develop between regular examinations. Overtime emergency call-back service must be limited to minor adjustments and repairs required to protect the immediate safety of the equipment and persons in and about the elevator.

E. Service and emergency personnel must report to the Contracting Officer or his authorized representative upon arrival at the hospital and again upon completion of the required work. A copy of the work ticket containing a complete description of the work performed must be given to the COR.

F. The Elevator Contractor must maintain a logbook in the machine room. The log must list the date and time of all bi-weekly examinations and all trouble calls. Each trouble call must be fully described including the nature of the call, necessary correction performed, or parts replaced.

G. Written “Maintenance Control Program” must be in place to maintain the equipment in compliance with ASME A17.1.

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SECTION 14 24 10

HYDRAULIC ELEVATOR – MODERNIZATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the engineering, furnishing and installation of the complete hydraulic elevator system as described herein and as indicated on the Building 28 contract drawings.

B. Items listed in the singular apply to each elevator in this specification except where noted.

C. Elevators C1, C2, C3 must be oil hydraulic, microprocessor control system and power-operated car and hoistway doors. Elevator must be Class “A” loading rated as a minimum.

ELEVATOR SCHEDULE	
Elevator Numbers	C1, C2, C3
Overall Platform Size	Field Verify
Clear Inside Platform	W66.5” x D104” x H96”
Rated Load – kg (lb)	5000#
Contract Speed - m/s (fpm)	125
Total Travel – m (ft)	<35’
Floors Served	G,1&2
Number of Openings	3
Entrance Type & Size	W48” x H84” LH/RH Two Speed Side Sliding
Plunger Size	Field Verify

1.2 RELATED WORK

A. Section 01 33 23 SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.

B. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-rated construction.

C. 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.

D. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirements for seismic restraint of non-structural components.
E. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.
F. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.
G. 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.
H. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.

I. Section 26 22 00, LOW-VOLTAGE TRANSFORMERS: Low voltage transformers.
J. Section 26 24 16, PANELBOARDS: Low voltage panelboards.
K. Section 26 43 13, TRANSIENT-VOLTAGE SURGE SUPPRESSION: Surge suppressors installed in panelboards.
L. Section 26 51 00, INTERIOR LIGHTING: Fixture and ballast type for interior lighting

1.3 QUALIFICATIONS

A. Approval by the Contracting Officer is required for products and services of proposed manufacturers, suppliers, installers and must be contingent upon submission of certificates by the Contractor stating the following:
   1. Elevator contractor is currently and regularly engaged in the installation of elevator equipment as one of his principal products.
   2. Elevator contractor must have five (5) years of successful experience, trained supervisory personnel and facilities to install elevator equipment specified herein.
   3. Elevator Mechanic (Installer) must 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 must

be actively pursuing Certified Elevator Mechanic status. Certification must be submitted for all workers employed in this capacity.

B. Welding at the project site must be performed by certified welders who have previously qualified by test as prescribed in American Welding Society Publications AWS Dl.1 to perform the type of work required. Certificates must be submitted for all workers employed in this capacity. A welding or hot work permit is required for each day and must be obtained from the VAMC safety department. Request permit one day in advance.

C. Electrical work must be performed by a Licensed Master Electrician and Licensed Journeymen Electricians as requirements by NEC. Certificates must be submitted for all workers employed in this capacity.

D. Approval will not be given to elevator contractors and manufacturers who have established on prior projects, either government, municipal, or commercial, a record of 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.

E. Approval of Elevator Contractor’s equipment will be contingent upon their providing factory training, engineering and technical support, including all manuals, wiring diagrams and tools necessary for adjusting, maintenance, repair and testing of equipment to the VA for use by the VA’s designated Elevator Maintenance Service Provider.

F. Identifying an elevator maintenance service provider that must render services within two hours of receipt of notification, together with certification that the quantity and quality of replacement parts stock is enough to warranty continued operation of the elevator installation.

G. Equipment within a group of hydraulic elevators must be the product of the same manufacturer.

H. The Contractor must 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.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification. Elevator installation must meet the requirements of the latest editions published and adopted by the United States Department of Veterans Affairs on the date this contract is signed.

B. Federal Specifications (Fed. Spec.):
J-C-30B - Cable and Wire, Electrical (Power, Fixed Installation)
J-C-580 – Cord, Flexible and Wire, Fixture
W-S-610 – Splice Connectors
W-C-596F - Connector, Plug, Electrical; Connector, Receptacle, Electrical
W-F-406E - Fittings for Cable, Power, Electrical and Conduit, Metal, Flexible
HH-I-558C - Insulation, Blankets, Thermal (Mineral Fiber, Industrial Type)
W-F-408E - Fittings for Conduit, Metal, Rigid (Thick- Wall and Thin-wall (EMT) Type)
RR-W-410 - Wire Rope and Strand
TT-E-489J - Enamel, Alkyd, Gloss, Low VOC Content
QQ-S-766 - Steel, Stainless and Heat Resisting, Alloys, Plate, Sheet and Strip

C. American Society of Mechanical Engineers (ASME):
A17.1 - Safety Code for Elevators and Escalators
A17.2 - Inspectors Manual for Electric Elevators and Escalators

D. National Fire Protection Association:
NFPA 13 - Standard for the Installation of Sprinkler Systems
NFPA 70 - National Electrical Code (NEC)
NFPA 72 - National Fire Alarm and Signaling Code
NFPA 101 - Life Safety Code
NFPA 252 - Fire Test of Door Assemblies

E. International Building Code (IBC)

F. American Society for Testing and Materials (ASTM):
A1008/A1008M-09 - Steel, Sheet, Cold Rolled, Carbon, Structural, High Strength Low-Alloy and High Strength Low-Alloy with Improved Formability E1042-02 - Acoustically Absorptive Materials Applied by Trowel or Spray

G. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS):

SP-58 - Pipe Hangers and Supports

H. Society of Automotive Engineers, Inc. (SAE)
J517-91 - Hydraulic Hose, Standard

I. Gages:
For Sheet and Plate: U.S. Standard (USS)
For Wires: American Wire Gauge (AWG)

J. American Welding Society (AWS):
D1.1 - Structured Welding Code – Steel

K. National Electrical Manufacturers Association (NEMA):
LD-3 - High-Pressure Decorative Laminates

L. Underwriter's Laboratories (UL):
486A - Safety Wire Connectors for Copper Conductors
797 - Safety Electrical Metallic Tubing

M. Institute of Electrical and Electronic Engineers (IEEE)

N. Regulatory Standards:
Uniform Federal Accessibility Standards
Americans with Disabilities Act
VA Barrier Free Design Handbook H-18-13

O. National Elevator Industry, Inc.
NEII-1 Building Transportation Standards and Guidelines

1.5 SUBMITTALS

A. Submit in accordance with Specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.

B. Before execution of work, furnish information to evidence full compliance with contract requirements for proposed items. Such information must include, as required: Manufacturer's Name, Trade Names, Model or Catalog Number, Nameplate Data (size, capacity and rating) and corresponding specification reference (Federal or project specification number and paragraph). All submitted drawings and related elevator material must be forwarded to the Contracting Officer.

C. Shop Drawings:

1. Complete scaled and dimensioned layout in plan and section view showing the arrangement of equipment and all details of each elevator unit specified including:
   a. Complete layout showing location of storage tank/pump assembly, controller, piping layout, outside diameter of cylinder/plunger

assembly, size of car platform, car frame members and support assembly.

b. Car, guide rails, brackets, buffers and other components located in hoistway.

c. Rail bracket spacing and maximum vertical forces on guide rails in accordance with H-18-8 for Seismic Risk Zone 2 or greater.

d. Reaction at points of support and buffer impact loads.

e. Weight of principal parts.

f. Top and bottom clearances and over travel of the car.

g. Location of main line switch/shunt trip circuit breaker, switchboard panel, light switch and feeder extension points in the machine room.

2. Drawings of hoistway entrances and doors showing details of construction and method of fastening to the structural members of the building.

a. If drywall construction is used to enclose hoistway, submit details of interface fastenings between entrance frames and drywall.

b. Sill details including sill support.

D. Samples:

1. One each of stainless steel, 75 mm x 125 mm (3 in. x 5 in.).
2. One each of baked enamel, 75 mm x 125 mm (3 in. x 5 in.).
3. One each of color floor covering.
4. One each of protection pads, 75 mm x 125 mm (3 in. x 5 in.) if used.
5. One each car and hoistway Braille plate sample.
6. One each car and hall button sample.
7. One each car and hall lantern/position indicator sample.
8. One each wall and ceiling material finish sample.
9. One each car lighting sample.

E. Name of manufacturer, type or style designation and applicable data of the following equipment must be shown on the elevator layouts:

1. Storage tank/pump assembly.
2. Pump and motor, HP and RPM rating, Voltage, Starting and Full Load Ampere, Number of phases and Gallons per minute.
3. Controller.
4. Starters and Overload Current Protection Devices.

5. Car Safety Device; Rupture Valve and Manual Shut Off Valves.
6. Electric Door Operator; HP, RPM, Voltage and Ampere rating of motor.
7. Hoistway Door Interlocks.
8. Car Buffers; maximum and minimum rated load, maximum rated striking speed and stroke.
9. Cab Ventilation Unit; HP rating and CFM rating.

F. 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.

G. Complete dimensioned detail of vibration isolating foundations for storage tank/pump assembly.

H. Dimensioned drawings showing details of:
1. All signal and operating fixtures.
2. Car slide guides/roller guides.
3. Hoistway door tracks, hangers and sills.
4. Door operator, infrared curtain units.

I. Cut sheets or drawings showing details of controllers and supervisory panels.

J. Furnish certificates as required under: Paragraph "QUALIFICATIONS".

1.6 WIRING DIAGRAMS

A. Provide three complete sets of paper and one electronic set of 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/Contracting Officer or authorized representative.

B. In the event field modifications are necessary during installation, diagrams must be revised to include all corrections made prior to and during the final inspection. Corrected diagrams must be delivered to the Resident Engineer/Contracting Officer within 30 days of final acceptance.

C. Provide the following information relating to the specific type of microprocessor controls installed:
1. Owner's information manual, containing job specific data on major components, maintenance and adjustment.
2. System logic description.

3. Complete wiring diagrams needed for field troubleshooting, adjustment, repair and replacement of components. Diagrams must be base diagrams, containing all changes and additions made to the equipment during the design and construction period.
4. Changes made during the warranty period must 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.

1.7 PERFORMANCE STANDARDS

A. The elevators must meet the highest standards of the industry and specifically the following:
   1. Contract speed is high speed in either direction of travel with rated capacity load in the elevator. Speed variation under all load conditions, regardless of direction of travel, must not vary more than five (5) percent.
   2. The controlled rate of change of acceleration and retardation of the car must not exceed 0.1G per ft/s/s and the maximum acceleration and retardation must not exceed 0.2G per ft/s/s.
   3. Starting, stopping and leveling must be smooth and comfortable without appreciable steps of acceleration and deceleration.

B. The door operator must open the car door and hoistway door simultaneously at 2.5-feet per second and close at 1-foot per second.

C. Pressure: Fluid system components must be designed and factory tested for 500 psi operating pressure.

D. Floor level stopping accuracy must be within 3 mm (.125 in.) above or below the floor, regardless of load condition.

E. Noise and Vibration Isolation: All elevator equipment including their supports and fastenings to the building, must be mechanically and electrically isolated from the building structure to minimize objectionable noise and vibration transmission to car, building structure, or adjacent occupied areas of building.

F. Sound Isolation: Noise level relating to elevator equipment operation in machine room must not exceed 80 decibels. All db readings must be taken three (3) feet off the floor and three (3) feet from equipment.

G. Airborne Noise: Measured noise level of elevator equipment during operation must not exceed 50 decibels in elevator lobbies and 60

decibels inside car under any condition including door operation and car ventilation exhaust blower on its highest speed.

1.8 WARRANTY

A. Submit all labor and materials furnished regarding elevator system and installation to terms of "Warranty of Construction" articles of FAR clause 52.246-21. The One-Year Warranty and Guarantee Period of Service must commence and run concurrent after final inspection, completion of performance test and upon acceptance of each elevator.

B. 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 must be removed and a new device meeting all requirements must be installed as part of work until satisfactory operation of installation is obtained. Period of warranty must start anew for such parts from date of completion of each new installation performed, in accordance with foregoing requirements.

1.9 POWER SUPPLY

A. For power supply in each machine room, see Specification 26 05 19, Electrical specifications and Electrical drawings.

B. Main Line Fused Disconnect Switch/Shunt Trip Circuit Breaker for each controller must be located inside the machine room at the strike side of the machine room door and lockable in the “Off” position.

C. Provide Surge Suppressors to protect the elevator equipment.

1.10 EMERGENCY POWER SUPPLY

A. Emergency power supply, its starting means, transfer switch for transfer of elevator supply from normal to emergency power, two pair of conductors in a conduit from an auxiliary contact on the transfer switch (open or close contacts as required by Elevator Controller Manufacturer) to terminals in the group elevator controller and other related work must be provided by the Electrical Contractor.

B. Upon loss of normal power supply there must be a delay before transferring to emergency power of 10 seconds minimum to 45 seconds maximum, the delay must be accomplished through an adjustable timing device.

C. Prior to the return of normal power an adjustable timed circuit must be activated that will cause all cars to remain at a floor if already there or stop and remain at the next floor if in flight. Actual

transfer of power from emergency power to normal building power must take place after all cars are stopped at a floor with their doors open.

D. Car lighting circuits must be connected to the emergency power panel.

1.11 ELEVATOR MACHINE ROOM

A. Reuse existing machine room and meet the requirements of ASME A17.1, NFPA 70, NFPA 101 and IBC. The elevator drive machine and elevator controller must be in the same code approved machine room.

B. Locate the shunt trip breakers and machine room light switch to the lock side of the door inside the room.

C. Locate sprinkler pipes to provide seven (7) feet head clearance. Do not locate sprinkler heads, heat detectors and smoke detectors directly over elevator equipment.

1.12 HOISTWAY LIGHTING

A. Provide lighting with 3-way switches at the top and bottom of the hoistway accessible from elevator hoistway entrance prior to entering the pit or stepping onto the car top.

B. Lighting must illuminate top of elevator cab when it is at the top floor and the pit when at the bottom floor.

1.13 TOOL CABINET

A. Provide a metal parts/tool cabinet, having two shelves and hinged doors. Cabinet must be 1219 mm (48 in.) high, 762 mm (30 in.) wide and 457 mm (18 in.) deep.

1.14 WORK SCHEDULE

A. Before starting work submit a detailed work schedule for approval and arrange with COR sequence of procedure, means of access to premises, space for storage, use of approaches, corridors, stairways, elevators, location of temporary partitions, disposal of trash and recyclable materials. The COR must be notified twenty (20) calendar days, in writing, in advance of starting work on elevators. No work may begin on any elevator until all materials for that elevator have been delivered to the site and verified by the Contracting Officer and/or Contracting Officer’s Representative. The phasing of work on the elevators must be coordinated with the Contracting Officer and/or the Contracting Officer’s Representative.

1.15 SAFETY PRECAUTIONS

A. Building #28 will be occupied during execution of work. Work must be conducted in a manner to afford maximum protection of patients, public,

employees, building and facilities to prevent unreasonable delay or interference with normal functioning of hospital activities.

B. Where an adjacent elevator is in operation, isolate the elevators from each other with suitable barriers between them, extending from the pit floor to bottom of secondary slab at top of hoistway, while work is in progress. Remove partition when work is completed.

C. Provide fire extinguishers that are readily available always.

D. It must be the obligation of the contractor to maintain a free and clear passageway in each elevator lobby. Parts and tools must be kept within the confines of entrance partitions. Trash and debris must be removed daily.

E. Provide fire rated partition during the modernization of elevators. Barrier must extend to the full height of the elevator entrance and must be dust and vapor proof with dust absorbing mats at access points.

1.16 REMOVAL OF MATERIALS AND EQUIPMENT

A. Material and equipment that are not specified to be reused or retained under contract must be removed daily from the site at the expense of the contractor. The contractor must receive title to all material and equipment not specified to be reused as of date of withdrawal from service. The government does not warranty condition of the material to which contractor must obtain title, nor must the government be liable for damage before or after title passes to contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Where stainless steel is specified, it must be corrosion resisting steel complying with Fed. Spec. QQ-S-766, Class 302 or 304, Condition A with Number 4 finish on exposed surfaces. Stainless steel must have the grain of belting in the direction of the longest dimension and surfaces must be smooth and without waves. During installation stainless steel surfaces must be protected with a suitable material.

B. Where cold rolled steel is specified, it must be low-carbon steel rolled to stretcher level standard flatness, complying with ASTM A109.

2.2 MANUFACTURED PRODUCTS

A. Materials, devices and equipment furnished must be of current production by manufacturers regularly engaged in the manufacture of such items. The elevator equipment, including controllers, door operators and supervisory system must be the product of manufacturers

of established reputation, provided such items are capably engineered and produced under coordinated specifications to ensure compatibility with the total operating system.

B. Manufacturers of equipment assemblies which include components made by others must assume complete responsibility for the final assembled unit. Components must be compatible with each other and with the total assembly for the intended service.

C. Mixing of manufactures related to a single system or group of components must be identified in the submittals.

D. Key operated switches provide for this elevator modernization, must be provide four (4) keys for each individual switch or lock. Provide different key tumblers for different switch and lock functions. Each key must have a tag bearing a stamped or etched legend identifying its purpose.

2.3 CONDUIT AND WIREWAY

A. Remove existing and provide new conduit and wireway. Install electrical conductors, except traveling cable connected to the elevator, in rigid zinc-coated steel or aluminum conduit, electrical metallic tubing or metal wireways. Rigid conduit smaller than .75 inch or electrical metallic tubing smaller than .50-inch electrical trade size must not be used. All raceways completely embedded in concrete slabs, walls, or floor fill must be rigid steel conduit. Wireway (duct) must be installed in the hoistway and to the controller and between similar apparatus in the elevator machine room. Fully protect self-supporting connections, where approved, from abrasion or other mechanical injury. Flexible metal conduit not less than .375-inch electrical trade size may be used, not exceeding 18 inches in length unsupported, for short connections between risers and limit switches, interlocks and for other applications permitted by NEC.

B. All conduits terminating in steel cabinets, junction boxes, wireways, switch boxes, outlet boxes and similar locations must have approved insulation bushings. Install a steel lock nut under the bushings if they are constructed completely of insulating materials. Protect the conductors at ends of conduits not terminating in steel cabinets or boxes by terminal fittings having an insulated opening for the conductors.

C. Rigid conduit and EMT fittings using set screws or indentations as a means of attachment must not be used.

D. Connect motors or other items subject to movement, vibration or removal to the conduit or EMT systems with flexible, steel conduits.

2.4 CONDUCTORS

A. Remove existing and provide new. Conductors must be stranded or solid coated annealed copper in accordance with Federal Specification J-C-30B for Type RHW or THW. Where 16 and 18 AWG are permitted by NEC, single conductors or multiple conductor cables in accordance with Federal Specification J-C-580 for Type TF may be used provided the insulation of single conductor cable and outer jacket of multiple conductor cable is flame retardant and moisture resistant. Multiple conductor cable must have color or number coding for each conductor. Conductors for control boards must be in accordance with NEC. Joints or splices are not permitted in wiring except at outlets. Tap connectors may be used in wireways provided they meet all UL requirements.

B. Provide all conduit and wiring between machine room, hoistway and fixtures.

C. All wiring must test free from short circuits or ground faults. Insulation resistance between individual external conductors and between conductors and ground must be a minimum of one megohm.

D. Where size of conductors is not given, voltage and amperes must not exceed limits set by NEC.

E. Provide equipment grounding. Ground the conduits, supports, controller enclosure, motor, platform and car frame and all other non-current conducting metal enclosures for electrical equipment in accordance with NEC. The ground wires must be copper, green insulated and sized as required by NEC. Bond the grounding wires to all junction boxes, cabinets and wire raceways.

F. Terminal connections for all conductors used for external wiring between various items of elevator equipment must be solderless pressure wire connectors in accordance with Federal Specification W-S-610. The Elevator Contractor may, at his option, make these terminal connections on #10 gauge or smaller conductors with approved terminal eyelets set on the conductor with a special setting tool, or with an approved pressure type terminal block. Terminal blocks using pierce-through serrated washers are not acceptable.

2.5 TRAVELING CABLES

A. Remove existing and provide new flexible traveling cables conforming to the requirements of NEC. Traveling cables must run from the junction box on the car directly to the controller. Junction boxes on the car must 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. Terminal blocks must have permanent indelible identifying numbers for each connection. Cables must be securely anchored to avoid strain on individual terminal connections. Flame and moisture resistant outer covering must remain intact between junction boxes. Abrupt bending, twisting and distortion of the cables must not be permitted.

B. Provide spare conductors equal to 10 percent of the total number of conductors furnished, but not less than 5 spare conductors in each traveling cable.

C. Provide shielded wires for the auto dial telephone system within the traveling cable, five (5) pair shielded wires for card reader, one (1) RG-6 Ethernet cable for Wi-Fi, two (2) pair 14-gauge wires for 110 Volt power supply and wire for video display monitor if specified.

D. If traveling cables contact 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 may be installed from the hoistway suspension point to the elevator pit to prevent traveling cables from rubbing or chafing and securely fastened and tensioned to prevent buckling. Hardware cloth is not required when traveling cable is hung against a flat wall.

D. Supply wiring/co-axel cable needed to satisfy the video portion required by A17.1-2019, section 2.27.

2.6 CONTROLLER AND SUPERVISORY PANEL

A. Remove existing and provide new UL/CSA Labeled Controller. Mount all assemblies, power supplies, chassis switches and relays on a steel frame in a NEMA Type 1 General Purpose Enclosure. Cabinet must be securely attached to the building structure.

B. Properly identify each device on all panels by name, letter, or standard symbol which must be neatly stencil painted or decaled in an indelible and legible manner. Identification markings must be coordinated with identical markings used on wiring diagrams. The ampere

rating must be marked adjacent to all fuse holders. All spare conductors to controller and supervisory panel must be neatly formed, laced and identified.

C. Controller must be provided with wiring and components for additional future travel if required.

2.7 MICROPROCESSOR CONTROL SYSTEM

A. Provide a non-proprietary/non-OEM microprocessor control system with absolute position/speed feedback to control dispatching, signal functions, door operation and pump motor control. Complete details of the components and printed circuit boards, together with a complete operational description, must be submitted for approval. Provide closed transition SCR soft start.

B. Controller manufacturer must provide factory training, engineering and technical support, including all manuals, wiring diagrams and tools necessary for adjusting, maintenance, repair and testing of equipment to the VA for use by the VA’s designated Elevator Maintenance Service Provider.

C. Microprocessor dispatching system must evaluate building traffic demand including number of elevators in service, hall calls, car calls, elevator position, direction of travel, load in elevator, door status and select an elevator to answer hall calls for least possible passenger wait times.

D. Provide a low oil control feature that must shut off the motor and pump and return the elevator to the lowest landing. Upon reaching the lowest landing, doors will open automatically allowing passengers to leave the elevator and then doors must close. All control buttons, except the door open button, alarm bell button and the call for help button must be made ineffective.

2.8 MACHINE ROOM MONITOR

A. Provide a monitor in each machine room, separate monitors for each passenger elevator group and each service elevator group. Provide a separate keyboard for each monitor.

B. The monitor must contain indicators to provide the following information:

1. The floor where each elevator is currently located.
2. The direction that each elevator is currently traveling or is scheduled to travel.

3. The location and direction of currently registered hall calls.
4. Elevators that are currently out of service.
5. Elevators that are currently bypassing hall calls.
6. Elevators that are currently engaged in passenger transfers.
7. Operations program under which entire group is currently operating.
8. Zone divisions of the entire group.
9. Door positions.
10. Status indication for elevators on independent service, car top inspection, fire service, earthquake protection and activated stop switch and alarm bell.

C. The maintenance terminal must be suitable for all troubleshooting procedures related to the specific type of microprocessor installed on this project.

2.9 EMERGENCY POWER OPERATION

A. The control system for Elevator(s) must provide for the operation of at least one car per elevator group on emergency power upon failure of the normal power supply.

B. Auxiliary equipment on elevator controllers, wiring between associated elevator controllers and wiring between elevator controllers and remote selector panel as required to permit the elevators to operate as detailed, must be provided by the Elevator Contractor.

C. Upon loss of normal power supply there must be a delay before transferring to emergency power of 10 seconds minimum to 45 seconds maximum, the delay must be accomplished through an adjustable timing device. After adjusting delay, the associated elevators must function the same as on normal power or as follows:

1. Selector switch, Automatic position:

   a. Not more than one elevator at a time in each group must be automatically selected and returned to the main floor, at contract speed, cycle its car and hoistway doors and shut down, with "Door Open" button remaining operable.
   b. As each elevator reaches the designated floor and shuts down, another elevator must start and return to the designated floor.
   c. Elevators that have been manually removed from automatic service and are on independent service, fire service or medical emergency must receive an automatic return signal. Elevators on inspection service or out of service must not receive a signal.

d. When an elevator is given a signal to return and it is unable to start its movement to the designated floor within 30 seconds it must be by-passed. When an elevator is by-passed, another elevator must start and return.
e. This process must continue until all elevators have returned to the designated floor and shut down.
f. Any elevator or elevators by-passed on initial return signal must be signaled again.
g. When all cars in group have returned to designated floor, one elevator in each group must be designated for automatic operation. Individual cars in each group must restart at 5 second intervals.
h. Elevator(s) are keyed on to medical emergency service in the car prior to transfer to auxiliary power operation, medical emergency service must be retained. This elevator must be the first automatically selected elevator to operate on emergency power operation and complete its selected call demand. The elevator will return to the designated floor after the key switch is reset to normal position.

2. Selector switch, Manual operation:
   a. Selector switch must be mechanically and electrically interlocked to prevent the selection of more than one elevator from operating on auxiliary power.
   b. The selector switch must have positions marked with the number of each elevator controlled. It must also have a position marked "Automatic". When the selector switch is set to the automatic position, the medical emergency service car must operate on emergency power operation, or if none, the last car arriving at the designated floor must operate on emergency power operation.
   c. Change in selection of elevators must be by means of the selection switch and must occur only when the previous selected elevator is stopped at the designated floor.
   d. The selector switch must be locked out of operation when the system is in the normal mode of operation.
   e. Locate the selector switch above the hall push button at the designated level. The key switch must be a tumbler type lock furnished with four keys. The enclosure faceplate must be

identified "Emergency Power Control" with 13 mm (.50 in.) engraved letters filled with black paint.

D. Prior to the return of normal power an adjustable timer circuit must activate that will cause all cars to remain at a floor if already there or stop and remain at the next floor if in flight. Actual transfer of power from auxiliary power to normal building power must take place after all cars are stopped at a floor with their doors open.

E. Emergency Rescue Operation:

Provide a power source to send the elevator to the lowest landing. After the elevator has leveled at the lowest landing, provide power to open the car and hoistway doors automatically. After a predetermined time, the doors must close. Power must stay applied to the door open button to reopen the doors from the inside of the elevator. The elevator must remain shut down at the bottom landing until normal power is restored. Install a sign on the controller indicating that power is applied to emergency rescue operator and door operator during loss of normal power.

2.10 FIREFIGHTER’S SERVICE

A. Provide Firefighter’s Service. All key switches must be barrel-key FEOK1.
   1. Main Floor:
   2. Alternate Floor:
   3. Verify main and alternate floors with RE/CO or authorized representative.

2.11 INDEPENDENT SERVICE

A. Provide an INDEPENDENT SERVICE toggle switch in the service operating panel that must have its positions marked "ON" and "OFF". When the switch is in the "ON" position, the car must respond only to calls registered on its car dispatch buttons and must bypass all calls registered on landing push buttons. The car must start when a car call is registered, car call button or door close button is pressed, car and hoistway doors are closed and interlock circuits are made. When switch is returned to "OFF" position, normal service must be resumed.

2.12 MEDICAL EMERGENCY SERVICE – PATIENT CARE FACLITIES ONLY

A. Provisions must be made for calling elevator(s) to floors served by the elevator on an emergency basis, operating independently from the dispatch signals and landing call signals.

B. Install key switches in the floor landing push button fixture above the push buttons.

C. Provide a call registered light indicator adjacent to key switch. The key switch at the landings and in the car, must only be operable by authorized personnel with a key.

D. When key switch is activated at any floor, the call register light indicator must illuminate at the call floor and inside the elevator only. The elevator control system must instantly select an elevator to respond to the medical emergency call. Immediately upon selection, all car calls must be cancelled. If car is traveling away from the medical emergency call, it must slow down and stop at the nearest floor, maintain closed doors, reverse direction and proceed nonstop to the medical emergency call floor. If the car is traveling toward the medical emergency call floor, it must proceed to that floor nonstop. If at the time of selection, it is slowing down for a stop, the car must stop, maintain doors closed and start immediately toward the medical emergency floor.

E. Arriving at the medical emergency floor, the car must remain with doors open for 60 seconds. After this interval has expired and the car has not been placed on medical emergency operation inside the car, the car must automatically return to normal service.

F. Provide an LED illuminated indicator light next to the Medical Emergency key switch the same size as the Fire Service indicator.

1. Locate a “Medical Emergency” key switch above call buttons in the main car operating panel for selecting medical emergency service. Activation of the key switch will allow the car to accept a car call for any floor, close doors and proceed nonstop to the floor desired.
2. After medical emergency call has been completed the elevator must return to normal operation after the key is removed.

G. In the center of the rear cab panel provide a back lighted "MEDICAL EMERGENCY" LED illuminated display that must flash on and off continuously when the car is assigned to this operation and until it is restored to normal service. "MEDICAL EMERGENCY" indicator must be a photographic negative type 1828 mm (72 in.) to center above the floor, 152 mm (6 in.) wide X 76 mm (3 in.) high, with 12.5 mm (.50 in.) high letters legible only when illuminated.

H. If the car being operated on “Independent Service”, the medical emergency service indicator lights in the car operating panel and rear wall must be illuminated, buzzer must sound and the “Audio Voice” system must direct the attendant to return the car to automatic operation.

I. If the car is out of service and unable to answer medical emergency calls, the call register light must not illuminate.

J. Each key switch must have its identity legible and indelible engraved in faceplates. All lettering must be 6 mm (.25 in.) high, filled with black paint.

K. When Phase I fire recall is activated, it must over-ride elevators on medical emergency service and return them to the main or alternate fire service recall floor. When the fire emergency floor has been identified the attendants may complete their medical emergency run on Phase II firefighter’s operation if life safety is not affected.

2.13 SEISMIC REQUIREMENTS

A. Meet the requirements VA Seismic Design Manual H-18-8.

2.14 PUMP, MOTOR AND VALVE ASSEMBLY

A. Provide new “Dry Type” pump assembly for the control of the elevator self-contained in a unit fabricated of structural steel. The unit must consist of a hydraulic fluid pump, AC motor, oil control valves with down speed regulator, muffler, piping and fittings.

B. Enclose V-belt power unit on four open sides with not less than 16-gauge steel removable panel sections. Provide a 50 mm (2 in.) minimum, 100mm (4 in.) maximum air space between the top of the panels and bottom of tank. Line panels on the interior side with one-inch rigid acoustical insulation board. Install metal belt guard that can be removed with hand tools for servicing and inspection.

C. Control valves must be electronically controlled. Hydraulic fluid flow must be controlled to insure speed variation of not more than five (5) percent under all load conditions in either direction of travel. Locate the manual lowering valve, easily accessible, properly identified and not concealed within the storage tank. Mark the operating handle in red.

D. Pump must be designed for hydraulic elevator service, having a steady discharge without pulsation to give smooth and quiet operation. Pump output must be capable of lifting elevator car with rated capacity, with a speed variation of no more than five (5) percent between no load and full load. Hydraulic fluid by-pass must discharge directly into storage tank.

E. Provide motor specifically designed for elevator service, synchronous speed of 1800 RPM, not to exceed nameplate full load current by more than 10% and rated 120 starts per hour without exceeding a rise of 40 degrees C.

F. Provide isolation pads to prevent transmission of pump and motor vibration to the building.

G. Install blowout-proof, non-hammering, oil-hydraulic muffler in the hydraulic fluid supply pressure line near power unit in machine room. Design muffler to reduce to a minimum any pulsation or noises that may be transmitted through the hydraulic fluid into the hoistway.

2.15 HYDRAULIC SYSTEM

A. Construct the storage tank of sheet steel, welded construction and a steel cover with means for filling, a minimum one-inch protected vent opening and a valve drain connection. Tank must be sized to pass through machine room door as shown on drawings. Provide marked gauge to monitor hydraulic fluid level. Tank must be sized to hold volume of hydraulic fluid required to lift elevator to stop ring, plus a reserve of not less than ten gallons. Provide a baffle in the bottom of the tank to prevent entry of any sediment or foreign particles into hydraulic system. Baffle must also minimize aeration of hydraulic fluid. Permissible minimum hydraulic fluid level must be clearly indicated. Hydraulic fluid must be of good grade to assure free flow when cool and have minimum flash point of 380-400 degrees F. Provide initial supply of hydraulic fluid for operation of elevator.

1. Provide a means to maintain the fluid viscosity in the reservoir, pump and control valve at the manufacturer’s recommended operating temperature.

2. Provide a data plate on the tank frame indicating the characteristics of the hydraulic fluid used.

B. Provide and install connections between the storage tank, pump, muffler, operating valves and cylinder complete with necessary valves, pipe supports and fittings. Pipe must be minimum schedule 40 steel with threaded, flanged, or welded mechanical couplings. Size of pipe and couplings between cylinder and pumping unit must be such that fluid pressure loss is limited to 10 percent.

C. Hydraulic system working pressure must not exceed 500 psi under any load condition. Do not subject valves, piping and fittings to working pressure greater than those recommended by the manufacturer.

D. Support all horizontal piping. Place hangers or supports within 300 mm (12 in.) on each side of every change of direction of pipeline and space supports not over 304.8 cm (10 ft) apart. Secure vertical runs properly with iron clamps at sufficiently close intervals to carry weight of pipe and contents. Provide supports under pipe to floor.

1. Provide all piping from machine room to hoistway, including necessary supports or hangers. If remote piping is underground or in damp inaccessible areas, install hydraulic piping thru PVC sleeve.

E. Install pipe sleeves where pipes pass through walls or floors. After installation of piping, equip the sleeves with snug fitting inner liner of fire rated insulation.

F. Provide an automatic shut-off valve in the oil supply line at the cylinder inlet. Activate the automatic shut-off valve when there is more than a ten percent increase in high speed in the down direction. When activated, this device must immediately stop the descent of the elevator and hold the elevator. The exposed adjustments of the automatic shut-off valve must have their means of adjustment sealed after being set to their correct position.

G. Provide external tank shut-off valve to isolate hydraulic fluid during maintenance operations.

H. Provide shut-off valves in the pit near the cylinder and in the machine room capable of withstanding 150 percent of design operating pressure. Each manual valve must have an attached handle.

I. Provide oil-tight drip pan for assembled pumping unit, including storage tank. Pan must be not less than 16-gauge sheet steel, with one-inch sides.

J. Components of the hydraulic system must be factory certified to withstand pressure equal to twice the calculated working pressure.

2.16 HYDRAULIC PLUNGER ASSEMBLY REUSE EXISTING

A. Provide new cylinder and plunger sized to lift gross load the height specified. Factory test the plunger assembly at a pressure equal to twice the calculated working pressure, for strength and to insure freedom from leakage. Provide bottom of cylinder head with internal guide bearing and top of cylinder head with removable packing gland. Victaulic type packing gland head must not be permitted.
   1. Provide a bleeder valve located below the cylinder flange to release air or other gases from the system.
   2. Equip cylinder with drip ring below the packing gland to collect leakage of hydraulic fluid.
   3. Bolt the cylinder mounting brackets to footing channels that support the buffers.

B. Install a flexible tubing scavenger line with an electrically operated pump between the piston drip ring and oil storage tank. Scavenger line, pump and strainers must operate independently of hydraulic fluid pressure. Equip scavenger pump with a water float designed to prevent operation of the pump should the pit flood and designed to be manually reset. Secure pump and reservoir to the pit channels.

C. Plunger must be heavy seamless steel tubing, turned smooth and true to within plus or minus .38 mm (0.015 in.) tolerance and no diameter change greater than .07 mm (0.003 in.) per-inch of length. Where plunger is multi-piece construction, machine the joints to assure perfectly matching surfaces.
   1. Secure plunger to underside of platform supporting beams with fastenings capable of supporting four times the weight of the plunger. The platen plate must incorporate piston to car vibration isolation.
   2. Provide a stop ring welded or screwed to the bottom of plunger that must prevent the plunger from leaving its cylinder.
   3. Isolate plunger head from the platen plate to prevent corrosion or electrolysis.
   4. Protect plunger, repair or replace if gouged, nicked or scored.

2.17 HYDRAULIC CYLINDER CASING AND PVC LINER REUSE EXISTING

A. Clean casing and remove waste oil, sand and other waste materials from site.
B. Provide PVC casing liner to fit inside steel casing or fabricate liner with watertight bottom and a top flange gasket to seal plunger flange and form a complete, watertight, electrically non-conductive encasement of the entire unit.

2.18 CAR BUFFERS REUSE EXISTING

A. Provide two new spring buffers for the elevator. Securely fasten buffers and supports to the pit channels and in the alignment with striker plates on elevator. Buffers must have a permanently attached metal plate indicating its stroke and load rating. Buffer anchorage must not puncture pit waterproofing. Reuse existing if possible.
B. Provide pipe stanchions and struts as required to properly support the buffer.

2.19 GUIDE RAILS, SUPPORTS AND FASTENINGS REUSE EXISTING

A. Reuse existing. Clean, replace missing bolts and tighten as needed.

2.20 NORMAL AND FINAL TERMINAL STOPPING DEVICES

A. Mount new terminal slowdown switches and direction limit switches on the elevator or in hoistway to reduce speed and bring car to an automatic stop at the terminal landings.
   1. Switches must function with any load up to and including 100 percent of rated elevator capacity at any speed obtained in normal operation.
   2. Switches, when opened, must permit operation of elevator in reverse direction of travel.
B. Mount final terminal stopping switches in the hoistway.
   1. Switches must be positively opened should the car travel beyond the terminal direction limit switches.
   2. Switches must be independent of other stopping devices.
   3. Switches, when opened, must remove power from pump motor and control valves preventing operation of car in either direction.

2.21 CROSSHEAD DATA PLATE AND CODE DATA PLATE

A. Permanently attach a non-corrosive metal Data Plate to car crosshead.
B. Permanently attach a Code Data Plate, in plain view, to the controller.

2.22 WORKMAN'S LIGHTS AND OUTLETS

A. Provide duplex GFCI protected type receptacles and lamp, with guards on top of elevator car and beneath platform.

B. The receptacles must be in accordance with Fed. Spec. W-C-596 for Type D7, 2-pole, 3-wire grounded type rated for 15 amperes and 125 volts.

2.23 CARTOP OPERATING DEVICE

A. Provide a new cartop operating device.

B. The device must be activated by a toggle switch mounted in the device. The switch must be clearly marked "INSPECTION" and "NORMAL" on the faceplate, with 6 mm (.25 in.) letters.

C. Movement of the elevator must be accomplished by the continuous pressure on a direction button and a safety button.

D. Provide an emergency stop switch, push to stop/pull to run.

E. Provide permanent identification for the operation of all components in the device.

F. The device must be permanently attached to the elevator crosshead on the side of the elevator nearest to the hoistway doors used for accessing the top of the car.

2.24 LEVELING DEVICE

A. Car must be equipped with a new two-way leveling device to automatically bring the car to within 3 mm (.125 in.) of exact level with the landing for which a stop is initiated regardless of load in car or direction of travel.

B. If the car stops short or travels beyond the floor, the leveling device, within its zone must automatically correct this condition and maintain the car within 3 mm (.125 in.) of level with the floor landing regardless of the load carried.

2.25 EMERGENCY STOP SWITCHES

A. Provide an emergency stop switch, push to stop/pull to run, for the top-of-car device, pit, machine spaces, service panel and firefighter's control panel inside the elevator. Mount stop switches in the pit adjacent to pit access door, at top of the pit ladder 1219 mm (48 in.) above the bottom landing sill and 1219 mm (48 in.) above the pit floor adjacent to the pit ladder.

B. Each stop switch must be red in color and must have "STOP" and "RUN" positions legibly and indelibly identified.

2.26 MAIN CAR OPERATING PANEL

A. Provide new main car operating panel in the car enclosure on the front return panel for passenger/service elevators. The top floor car call push button must not be more than 1219 mm (48 in.) above the finished floor. “Vandal Resistant” car push buttons and indicator lights must be LED illuminated, round with a minimum diameter of 25 mm (1 in.). Each button must contain an integral registration LED white light which must illuminate upon registration of a call and must extinguish when that call is answered.

B. One-piece hinged front faceplate with edges beveled 15 degrees must have the firefighter’s service panel recessed into the upper section and the service operation panel recessed into the lower section fitted with hinged doors. Doors must have concealed hinges, be in the same front plane as the faceplate and fitted with cylinder type key operated locks. Secure the faceplate with stainless steel tamperproof screws.

C. All terminology and tactile symbols on the faceplate must be on square or rectangular plates recessed into the faceplate with its surface flush with the surface of the faceplate. Use 6 mm (.25 in.) letters to identify all devices in the faceplate. The handicapped markings with contrasting background must be 12.5 mm (.50 in.) high raised .075 mm (.030 in.) on the plate. Surface mounted plates are not acceptable.

D. The upper section must contain the following items in order listed from top to bottom:

1. Elevator number, 12.5 mm (.50 in.) high with black paint for contrast.
2. Capacity plate information with black paint for contrast with freight loading class and number of passengers allowed.
3. LED illuminated digital car position indicator with direction arrows.
4. Emergency car lighting system consisting of a rechargeable battery, charger, controls and LED illuminated light fixture. The system must automatically provide emergency light in the car upon failure or interruption of the normal car lighting service and function irrespective of the position of the light control switch in the car. The system must maintain a minimum illumination of 1.0 foot-candle when measured 1219 mm (48 in.) above the car floor and approximately 305 mm (12 in.) in front of the car operating panel, for not less than four (4) hours.

5. Firefighter’s Emergency Operation Panel must be 1650 mm (66 in.) minimum to 1828 mm (72 in.) maximum to the top of the panel above finished floor.
6. Firefighter’s Emergency Indicator Light must be round with a minimum diameter of 25 mm (1 in.).
   diameter of 25 mm (1 in.). Instruction for Medical Emergency operation must be adjacent to the key switch and light.
8. Key operated Independent Service Switch on the face of panel. (Delete if inside service panel).
9. Provide a Door Hold Button on the faceplate above the call buttons. It must have “DOOR HOLD” indelibly marked on the button. Button must light when activated. When activated, the door must stay open for a maximum of one minute. To override hold timer, push a car call button or door close button.
10. Provide round “Vandal Resistant” car push buttons and indicator lights, minimum diameter of 25 mm (1 in.) and LED illuminated, corresponding to the floors served. Car call buttons must be legibly and indelibly identified by a floor number, letter or symbol not less than 12.5 mm (.50 in.) high in the face of the button or indicator.
11. Door Open and Door Close buttons must be located below the car call buttons. They must have “OPEN” and “CLOSE” legibly and indelibly identified by letters in the face of the respective button. The Door Open button must be located closest to the door jamb.
    a. Rear Door Open and Rear Door Close buttons must be located below the Front Door Open and Front Door Close buttons. They must have “REAR OPEN” and “REAR CLOSE” legibly and indelibly identified by letters in the face of the respective button.
12. Red Emergency Alarm button that must be located below the car operating buttons. Mount the emergency alarm button not lower than 875 mm (35 in.) above the finished floor. It must be connected to audible signaling devices. Provide audible signaling devices including the necessary wiring.
13. Emergency Help push button must activate two-way communications by Auto Dial telephone system that is compatible with the VAMC’s telephone system. Help button must be LED white light illuminated and flash when call is acknowledged. Legibly and indelibly label the

button “HELP” in the face of the button with 12.5 mm (.50 in.) high letters.

E. The service operation panel, in the lower section must contain the following items:
   1. Light switch labeled “LIGHTS” for controlling interior car lighting with its two positions marked “ON” and “OFF”.
   2. Inspection switch that will disconnect normal operation and activate hoistway access switches at terminal landings. Switch must be labeled “ACCESS ENABLE” with its two positions marked “ON” and “OFF”.
   3. Three position switch labeled “FAN” with its positions marked “HIGH”, “LOW” and “OFF” for controlling car ventilating blower.
   4. Two position, spring return, toggle switch or push button to test the emergency light and alarm device. It must be labeled “TEST EMERGENCY LIGHT AND ALARM”.
   5. Independent service switch labeled “ON” AND “OFF”. (Delete if key switch on face of panel).

2.27 AUXILIARY CAR OPERATING PANEL

A. Provide an auxiliary car operating panel in the side wall of the elevator between the handrails immediately adjacent to the front entrance column strike jamb. The auxiliary car operating panel must contain only those controls essential to passenger (public) operation. The auxiliary car operating panel faceplate must match the main car operating panel faceplate in material and general design. Secure the faceplate with stainless steel tamperproof screws.
   1. Provide round “Vandal Resistant” car push buttons and indicator lights, minimum diameter 25 mm (1 in.) and LED illuminated corresponding to the floors served. Car buttons and indicator lights must be legibly and indelibly identified by a floor number, letter, or symbol not less than 12.5 mm (.50 in.) high in the face of the button or indicator light corresponding to the main car operating panel buttons or indicator light.
   2. Door "OPEN" and door "CLOSE" buttons closest to the door jamb and mount the alarm button no lower than 889 mm (35 in.) above the

finished floor. The Door Open button must be located closest to the door.

3. Cross-connect all buttons in the auxiliary car operating panels to their corresponding buttons in the main car operating panel. Registration of a car call must cause the corresponding button to illuminate in the main and auxiliary car operating panel.
4. Emergency Help push button must activate two-way communications by auto dial telephone that is compatible with the VAMC's telephone system. Help button must be LED white light illuminated and flash when call is acknowledged. Legibly and indelibly label the button "HELP" in the face of the button with 12.5 mm (.50 in.) high letters.

B. All terminology and tactile symbols on the faceplate must be on square or rectangular plates recessed into the faceplate with its surface flush with the surface of the faceplate. Use 6 mm (.25 in.) letters to identify all devices in the faceplate. The tactile symbols with contrasting background must be 12.5 mm (0.5 in.) high raised .075 mm (.030 in.) on the plate. Surface mounted plates are not acceptable.

2.28 CAR POSITION INDICATOR

A. Provide an alpha-numeric digital car position indicator in the main car operating panel, consisting of numerals and arrows 63 mm (2.5 in.) high, to indicate position of car and direction of car travel. Locate position indicator at the top of the main car operating panel, illuminated by light emitting diodes.

2.29 AUDIO VOICE SYSTEM

A. Provide digitized audio voice system activated by stopping at a floor. Audio voice must announce floor designations, direction of travel and special announcements. The voice announcement system must be a natural sounding human voice that receives messages and must comply with ADA requirements for audible car position indicators. The voice announcer must have two separate volume controls, one for the floor designations and direction of travel and another for special announcements. The voice announcer must have a full range loudspeaker, located on top of the cab. The audio voice unit must contain the number of ports necessary to accommodate the number of floors, direction messages and special announcements. Install voice announcer per manufacturer's recommendations and instructions. The voice system must be the product

of a manufacturer of established reputation. Provide manufacturer literature and list of voice messages.

1. Fire Service Message.
2. “Please do not block doors”.
3. Provide special messages as directed by COR.

2.30 AUTO DIAL TELEPHONE SYSTEM

A. Provide a complete, ADA compliant, auto dial communication system that is compatible with the VAMC’s telephone system.

B. Two-way communication device shall be in full compliance with ASME A17.1 Rule 2.27.1.1 (2019) or later editions.

2.31 CORRIDOR OPERATING DEVICES

A. Provide new corridor operating device faceplates from not less than 3 mm (.125 in.) thick flat stainless steel with all edges beveled 15 degrees.

B. Corridor push button faceplates must be sized to cover existing openings in the walls. The centerline of the landing push buttons must be 1067 mm (42 in.) above the corridor floor.

C. Elevator Corridor Call Station Pictograph must be engraved in the faceplate.

D. Fasten all car and corridor operating device and signal device faceplates with stainless steel tamperproof screws.

E. All terminology and tactile symbols on the faceplate must be raised .030 inch with contrasting background, on square or rectangular plates recessed into the faceplate with its surface flush with the surface of the faceplate. The handicapped markings with contrasting background must be 12.5 mm (0.5 in.) high raised .075 mm (.030 in.) on the plate, square or rectangular. Use 6 mm (.25 in.) letters to identify all other devices in the faceplate. Surface mounted plates are not acceptable.

F. Provide one riser of landing call buttons for each elevator or group of elevators as shown on contract drawings.

G. “Vandal Resistant” hall buttons and indicator lights must be LED illuminated upon registration of a call and shall extinguish when that call is answered.

H. The direction of each button must be legibly and indelibly identified by arrows not less than 12.5 mm (.50 in.) high in the face of each button. Provide a corresponding Braille plate on the left side of each button.

I. Hall call buttons must not re-open the doors while the car and hoistway doors are closing at that floor, the call must be registered for the next available elevator. Calls registered must be canceled if closing doors are re-opened by means of "DOOR OPEN" button or infrared curtain unit.

J. Provide emergency power indicator light, fire service recall key switch and indicator light, fire recall instruction, communication failure light, audible enunciator and reset key switch in the fixture at the designated main floor.

K. Remove old fixtures and fully cover void with a stainless-steel plate. Finish must match existing door frame finish.

L. Submit design of hall pushbutton fixtures for approval.

2.32 CORRIDOR ARRIVAL LANTERN/POSITION INDICATOR

A. Provide new combination corridor lantern/position indicator digital display mounted over the hoistway entrances at each floor in healthcare facilities. For non-healthcare facilities provide combination fixtures only at main and alternate fire recall floors. Provide each terminal landing with "UP" or "DOWN", minimum 63 mm (2.5 in.) high digital arrow lanterns and each intermediate landing with "UP" and "DOWN" digital arrow lanterns. Each lens must be LED illuminated of proper intensity, so shielded to illuminate individual lens only. The lenses in each lantern must be illuminated green to indicate "UP" travel and red to indicate "DOWN" travel. Lanterns must signal in advance of car arrival at the landing indicating the direction of travel. Corridor lanterns must not be illuminated when a car passes a floor without stopping. Each lantern must be equipped with an audible electronic chime which must sound once for "UPWARD" bound car and twice for "DOWNWARD" bound car. Audible signal must not sound when a car passes the floor without stopping. Provide adjustable sound level on audible signal. Car riding lanterns are not acceptable.

B. Install alpha-numeric digital position indicator between the arrival lanterns. Indicator faceplate must be stainless steel. Numerals must be not less than 63 mm (2.5 in.) high with direction arrows. Cover plates must be readily removable for re-lamping. The appropriate direction arrow must be illuminated during entire travel of car in corresponding direction.

C. Remove old fixtures, repair and refinish walls.

2.33 HOISTWAY ACCESS

A. Provide new n hoistway access switches for elevator at top terminal landing to permit access to top of car and at bottom terminal landing to permit access to pit. Elevators with side slide doors, mount the access key switch 182.9 cm (6 ft) above the corridor floor in the wall next to the strike jamb.
B. Exposed portion of each access switch or its faceplate must have legible, indelible legends to indicate "UP", "DOWN" and "OFF" positions.
C. Each access switch must be a constant pressure cylinder type lock having not less than five pins or five stainless steel disc combination with key removable only when switch is in the "OFF" position.
D. Lock must not be operable by any other key which will operate any other lock or device used for any other purpose at the VA Medical Center.
E. Arrange the hoistway switch to initiate and maintain movement of the car. When the elevator is operated in the down direction from the top terminal landing, limit the zone of travel to a distance not greater than the top of the car crosshead level with the top floor. Submit design and location of access switches for approval.
F. Provide emergency access for all hoistway entrances, keyways for passenger and service elevators.

2.34 HOISTWAY ENTRANCES: PASSENGER/SERVICE ELEVATORS

A. Refinish existing stainless-steel entrance frames or paint existing painted entrance frames or clad existing entrance frames in stainless steel.
B. Clean and reuse existing hoistway sills, hanger supports, strut angles, fascia plates and toe guards.
C. Replace all damaged or missing dust covers.
D. Provide new stainless steel hoistway doors. Door panels must be flush hollow metal construction, not less than 32 mm (1.25 in.) thick, consisting of one continuous piece 16-gauge stainless steel on corridor side wrapped around the leading edge. Separate two plates by a sound-

deadening material and reinforce by steel shapes welded to the plates at frequent intervals. Reinforce panels as required for installation of hangers, power-operating and door-opening devices. Top and bottom of door panels must have continuous stiffener channels welded in place. Reinforcement of the door panels must be a minimum of 1.0 mm (0.04 in.) in thickness and of the hat section type.

E. Hang doors on two-point suspension hangers having sealed ball-bearing sheaves not less than 76 mm (3 in.) in diameter, with non-metallic sound-reducing tires. Equip hangers with adjustable ball-bearing rollers to take upward thrust of panels. Provide two removable non-metallic door gibs of approved material and a separate fire gib at the bottom of each door panel. Gibs must be replaceable without removing of door panel. One door panel for each entrance must bear a BOCA label, Underwriters' label, or other labels may be furnished provided they are based on fire test reports and factory inspection procedures acceptable to the COR. Fasten stainless steel sight guard of 14-gauge metal, extending full height of panel, to leading edge of fast speed panel of two-speed doors.

F. Provide new hardware, tracks, gibs, separate fire gibs, door rollers, door locks, drive roller assemblies and sill mounted closers.

G. Reuse Braille plates on both sides of door frame entrances located 1523 mm (60 in.) to center above finished floor. Replace damaged or missing Braille plates.

H. Provide unique car number on every elevator entrance at designated main fire service floor level, minimum 76 mm (3 in.) in height.

I. Equip each hoistway entrance with new electrical/mechanical interlock, functioning as hoistway unit system, to prevent operation of elevator until all hoistway doors are locked in the closed position unless car is operating in the leveling zone or hoistway access switch is used.

J. Wiring installed from the hoistway riser to each door interlock must be NEC type SF-2 or equivalent.

2.35 CAR GUIDES REUSE EXISTING

A. Provide new adjustable roller guides, each assembled on a substantial metal base, to permit individual alignment to the guide rails.

B. Each guide must consisting of not less than three (3) wheels, each with a durable, resilient oil-resistant material tire rotating on ball

bearings having sealed-in lubrication. Assemble rollers on a substantial metal base and mount to provide continuous spring pressure contact of all wheels with the corresponding rail surfaces under all conditions of loading and operation. Secure the roller guides at top and bottom on each side of car frame and counterweight frame. All mounting bolts must be fitted with nuts, flat washers, split lock washers and if required, beveled washers.

C. Provide sheet metal guards to protect rollers on top of car and counterweight.

D. Minimum diameter of car rollers must be 150 mm (6 in.). The entire elevator car must be properly balanced to equalize pressure on all guide rollers. Cars must be balanced in post-wise and front-to-back directions. Test for this balanced condition must be witnessed at time of final inspection.

E. Equip car with an auxiliary guiding device for each guide that must prevent the car from leaving the rails if the normal guides fail. These auxiliary guides must not, during normal operation, touch the guiding surfaces of the rails. Fabricate the auxiliary guides from hot rolled steel plate and mount between the normal guide shoes and the car frames. The auxiliary guides may be an extension of the normal guide shoe mounting plate if that plate is fabricated from hot rolled steel. The portion of the auxiliary guide which must contacts the rail guiding surfaces in the event of loss of the normal guides must be lined with an approved bearing material to minimize damage to the rail guiding surfaces.

2.36 CAR FRAME: PASSENGER/SERVICE ELEVATORS.

A. Reuse existing car frame. Tighten bolts and replace missing bolts.

2.37 CAR PLATFORM: PASSENGER/SERVICE ELEVATORS

A. Provide a platform guard (toe guard) of not less than 12-guage sheet-steel on the entrance side, extend 76 mm (3 in.) beyond each side of entrance jamb. Securely brace platform guard to car platform and bevel bottom edge at a 60-75-degree angle from horizontal. Install platform in the hoistway, so that the clearance between front edge and landing threshold must not exceed 32 mm (1.25 in.).

B. Provide new isolation pads between the platform and platform frame, where needed. Use approved rubber pads or other approved material.

C. Provide a bonding wire between frame and platform.

2.38 CAR ENCLOSURE: PASSENGER/SERVICE ELEVATORS

A. Car enclosure must have a dome height inside the cab of 243.8 cm (8 ft).
B. Securely fasten car enclosure to platform by through bolts located at intervals of not more than 457 mm (18 in.) running through an angle at the base of panels to underside of platform.
C. Front return wall panel, entrance columns, entrance head-jamb and transom must be 14-gauge stainless steel. Transom must be full width of cab. Side and rear walls must be constructed of 14-gauge cold rolled steel. Coat exterior of walls with mastic sound insulation material approximately 2.5 mm (.10 in.) thick followed by a prime coat of paint.
D. Side and rear walls of passenger elevators may have raised panels covered in fire rated materials approved for use in elevator interior.
E. Side and rear walls of service elevators, up to the center line of the top handrail, must be covered with stainless steel. Side and rear walls to the ceiling must be covered with high pressure plastic laminate panels or stainless steel applied directly to the cab walls or raised panels as directed by the VA COR. Submit a method of fastening panels to steel walls.
F. Construct canopy of not less than 12-gauge steel.
G. Provide car top railings.
H. Provide a hinged top emergency exit cover. Exit must be unobstructed when open and must have mechanical stops on the cover. Provide an exit switch to prevent operation of the elevator when the emergency exit is open.
I. Provide duplex, GFCI protected receptacle in car. Locate flush-mounted receptacle on the centerline of the main car operating panel, 150 mm (6 in.) above the car floor.
J. Lighting for passenger/service elevators:
   1. Provide stainless steel hanging ceiling frame. Construct frame of 3.125 mm (.125 in.) thick x 38 mm (1.50 in.) wide x 38 mm (1.50 in.) high “T” and “L” sections, divide ceiling into six panels.

   2. Provide LED illuminated car light fixtures above the ceiling panels. Maintain a minimum light level of 50-foot candles at 914 mm (36 in.) above the finished floor.

K. Optional lighting for service elevators:
   1. Provide car with indirect LED lamps mounted front to rear in lighting coves along each side of the cab ceiling, no hanging ceiling.
   2. Equip the lighting cove with asymmetrical reflectors having specular finish. Maintain a minimum light level of 50-foot candles 914 mm (36 in.) above finished floor at the car operating panels.
   3. Enclose the entire vertical space between the light trough outer edge and the cab canopy with approved opaque white or clear lumicite sheeting. Lumicite sheeting must be removable for cleaning and re-lamping.

L. Provide a blower unit arranged to exhaust through an opening in the canopy. Provide a stainless or chrome plated fan grill on the interior side of the opening. Provide screening over intake and exhaust end of blower. Provide 2-speed fan, with rated air displacement of 250 cfm and 400 cfm at respective speeds. Mount fan on top of car with rubber isolation to prevent transmission of vibration to car structure. Provide a 3-position switch to control the unit in the service panel.

M. Provide car enclosure with two sets of handrails with centerlines 7’62 mm and 1067 mm (30 in. and 42 in.) above the car floor.
   1. Locate handrails 38 mm (1.50 in.) from cab wall. Install handrails on side and rear walls or side walls only for front and rear openings as applicable. Conceal all handrail fastenings. Handrails must be removable from inside the car enclosure.
   2. Provide service elevators with flat stock handrails with the ends at the entrance turned back to the wall.

N. Provide passenger car with single speed center opening horizontal sliding doors and service car with two-speed side opening horizontal sliding doors constructed the same as hoistway doors.

O. Provide one set of protective pads for service elevator of sufficient length to completely cover two sides, rear walls and front return of cab interior. Pads must consist of a minimum of 6 mm (.25 in.) thick glass fiber insulation securely sewn between flame resistant vinyl coated coverings. Color of the covering must be approved by the Contracting Officer. Provide stainless steel pad buttons or hooks, spaced at intervals of not more than 457 mm (18 in.) to adequately support pads.

2.38 CAR ENCLOSURE: PASSENGER/SERVICE ELEVATORS (ALTERNATE)

A. Reuse existing car enclosure. Refinish or replace damaged stainless-steel entrance panels.

B. Reuse car interior panels and flooring.

C. Provide car top railings.

D. Provide an exit switch to prevent operation of the elevator when the emergency exit is open.

E. Provide duplex, GFCI protected receptacle in car. Locate flush-mounted receptacle on the centerline of the main car operating panel, 150 mm (6 in.) above the car floor.

F. Reuse existing lighting for passenger and service elevators.

G. Reuse existing exhaust fan.

H. Reuse existing handrails inside elevators.

I. Provide passenger car with new single speed center opening horizontal sliding doors and service car with new two-speed side opening horizontal sliding doors constructed the same as hoistway doors.

2.39 POWER DOOR OPERATORS: PASSENGER/SERVICE ELEVATORS

A. Provide a new high-speed heavy-duty door operator to automatically open the car and hoistway doors simultaneously when the car is level with the floor and automatically close the doors simultaneously at the expiration of the door-open time. Provide solid-state door control with closed loop circuitry to constantly monitor and automatically adjust door operation based upon velocity, position and motor current. Motor must be of the high-internal resistance type, capable of withstanding high currents resulting from stall without damage to the motor. The door operator must open the car door and hoistway door simultaneously, at a speed of 76.2 cm (2.5 ft) per second. The closing speed of the doors must be 30.5 cm (1 ft) per second. A reversal of direction of the doors from the closing to opening operation, whether initiated by obstruction of the infrared curtain or the door "OPEN" button, must be accomplished within 38 mm (1.5 in.) maximum of door movement. Emphasis is placed on obtaining quiet interlock and door operation; smooth, fast, dynamic braking for door reversals, stopping of the door reversal and stopping of the doors at extremes of travel. Construct all levers and drive arms operating the doors, of heavy steel members and all pivot points must have ball or roller bearings.

B. Car and hoistway doors must be manually operable (open only) in an emergency without disconnecting the power door operating equipment unless the car is outside the unlocking zone.
   1. It must not be possible for the doors to open by power unless the elevator is within the leveling zone.
   2. Provide infrared curtain unit. The device must cause the car and hoistway doors to reverse automatically to the fully open position should the unit be actuated while the doors are closing. Unit must function when the doors are not closed, irrespective of all other operating features except firefighter’s service.
C. Should the doors be prevented from closing for more than a predetermined adjustable interval of 20 to 60 seconds by operation of the curtain unit, the doors must stay open, the audio voice message and a buzzer located on the car must sound only on automatic operation. Do not provide door nudging.
   1. If an obstruction of the doors should not activate the photo-electric door control device and prevent the doors from closing for more than a predetermined adjustable interval of 15 to 30 seconds, the doors must reverse to the fully open position and remain open until the “Door Close” button re-establishes the closing cycle.
D. Provide door "OPEN" and "CLOSE" buttons. When the door "OPEN" button is pressed and held, the doors, if in the open position, must remain open and if the doors are closing, they must stop, reverse and re-open. Momentary pressure of the door "CLOSE" button must initiate the closing of the doors prior to the expiration of the normal door open time.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine work of other trades on which the work of this section depends. Report defects to the COR in writing which may affect the work of the elevator contractor.
B. Examine elevator hoistway openings for plumb, level, in line and that elevator pit is proper size, waterproofed and drained with necessary access door and ladder.
C. Examine machine room for proper illumination, heating, ventilation, electrical equipment and beams are correctly located complete with access stairs and door.

D. Before fabrication, take necessary job site measurements and verify where work is governed by other trades. Check measurement of space for equipment and means of access for installation and operation. Obtain dimensions from site for preparation of shop drawings.

E. Work required prior to the completion of the elevator installation:
   1. Supply of electric feeder wires to the terminals of the elevator control panel, including circuit breaker.
   2. Provide light and GFCI outlets in the elevator pit and machine room.
   3. Furnish electric power for testing and adjusting elevator equipment.
   4. Furnish circuit breaker panel in machine room for car and hoistway lights and receptacles.
   5. Supply power for cab lighting and ventilation from an emergency power panel specified in Division 26, ELECTRICAL.
   6. Machine room enclosed and protected from moisture, with self-closing, self-locking door and access stairs.
   7. Provide fire extinguisher in machine room.

3.2 ARRANGEMENT OF EQUIPMENT

A. Arrange equipment in machine room so that major equipment components can be removed for repair or replacement without dismantling or removing other equipment in the same machine room. Locate controller near and visible to its respective hoisting machine.

3.3 WORKMANSHIP AND PROTECTION

A. Installations must be performed by Certified Elevator Mechanics and Apprentices to best possible industry standards. Details of the installation must be mechanically and electrically correct. Materials and equipment must be new and without imperfections.

B. Recesses, cutouts, slots, holes, patching, grouting, refinishing to accommodate installation of equipment must be included in the Contractor's work. All new holes in concrete must be core drilled.

C. Structural members must not be cut or altered. Work in place that is damaged or defaced must be restored equal to original new condition.

D. Finished work must be straight, plumb, level and square with smooth surfaces and lines. All machinery and equipment must be protected against dirt, water, or mechanical injury. At completion, all work must be thoroughly cleaned and delivered in perfect unblemished condition.

E. Sleeves for conduit and other small holes must project 51 mm (2 in.) above concrete slabs.

F. Exposed gears, sprockets and sheaves must be guarded from accidental contact.

3.4 CLEANING

A. After completion of installation and prior to final inspection, all equipment must be thoroughly cleaned of grease, oil, cement, plaster, dust and other debris.

B. Clean machine room and equipment.

C. Perform hoistway clean down.

D. Prior to final acceptance remove protective coverings from finished or ornamental surfaces. Clean and polish as required for type of material.

3.5 PAINTING AND FINISHING

A. All equipment, except specified as architectural finish, must be painted one coat of approved color, conforming to manufacturer's standard.

B. Pump Unit Assembly must be factory painted with manufacturer's standard finish and color.

C. Controller, car frame and platform, beams, rails and buffers except their machined surfaces, cams, brackets and all other uncoated ferrous metal items must be painted one factory primer coat or approved equal.

D. Stencil or apply decal floor designations not less than 100 mm (4 in.) high on hoistway doors, fascia or walls within door restrictor areas. The color of paint used must contrast with the color of the surfaces to which it is applied.

E. Elevator pump/motor machine, controller, main line switch/shunt trip circuit breaker, bolster channel and cross head of car must be identified by 100 mm (4 in.) high numerals and letters located as directed. Numerals must contrast with surrounding color and must be stenciled or decaled.

F. Hoistway Entrances of Passenger and Service Elevators:

1. Door panels must be given rust resistant treatment and a factory finish of one coat of baked-on primer and one factory finish coat of baked-on enamel.

2. 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) must be given one approved prime coat in the shop and one field coat of paint of approved color.

G. Elevator Cabs for Passenger and Service Elevators:
   1. Interior and exterior steel surfaces must be given rust resistant treatment before finish is applied.
   2. Interior steel surfaces must be factory finished with one coat of paint of approved color.
   3. Give exterior faces of car doors one finish coat of paint of approved color.

3.6 PRE-TESTS AND TESTS

A. Pre-test the elevators and related equipment in the presence of the Contracting Officer or his authorized representative for proper operation before requesting final inspection. Conduct final inspection at other than normal working hours, if required by Contracting Officer.
   1. The VA must obtain the services of an Independent Qualified Elevator Inspector, ANSI/ASME QEI-1 Certified, that must witness all tests. The QEI must utilize an Elevator Acceptance Inspection Form to record the results of inspection and all testing and to identify safety code and contract deficiencies. Specific values must be provided for all tests required by ASME A17.1, ASME A17.2 and contract documents. After completion of inspection and testing, the QEI must sign a copy of the completed form and provide it to the Contracting Officer. Within 14 days of the inspection, the QEI must also prepare a formal inspection report, including all test results and deficiencies. After successful completion of inspection and testing, the QEI will complete, sign and provide a certificate of compliance provide by the VA.
   2. Government must furnish electric power including necessary current for starting, testing and operating machinery of each elevator.
   3. Contractor must 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, stopwatch and a means of two-way communication.

B. Inspection of workmanship, equipment furnished and installation for compliance with specification.

C. Full-Load Run Test: Elevators must be tested for a period of one-hour continuous run with full contract load in the car. The test run must consist of the elevator stopping at all floors, in either direction of travel, for not less than five or more than ten seconds per floor.

D. Speed Test: The actual speed of the elevator must be determined in both directions of travel with full contract load and no load in the elevator. Speed must be determined by certified tachometer. The actual measured speed of the elevator with all loads in either direction must be within five (5) percent of specified rated speed. Full speed runs must be quiet and free from vibration and sway.

E. Temperature Rise Test: The temperature rise of the pump motor must be determined during the full load test run. Temperatures must be measured using thermometers. Under these conditions, the temperature rise of the equipment must not exceed 50 degrees Centigrade above ambient temperature. Test must start when all machine room equipment is within 5 degrees Centigrade of the ambient temperature. Other tests for heat runs on motors must be performed as prescribed by the Institute of Electrical and Electronic Engineers.

F. Car Leveling Test: Elevator car leveling devices must 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 must be within plus or minus 3 mm (.125 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 must automatically correct over travel as well as under travel and must maintain the car floor within plus or minus 3 mm (.125 in.) of level with the landing floor regardless of change in load.

G. Insulation Resistance Test: The elevator's complete wiring system must be free from short circuits and ground faults and the insulation resistance of the system must be determined by use of megohm meter, at the discretion of the Elevator Inspector conducting the test.

H. Overload Devices: Test all overload current protection devices in the system at final inspection.

I. Limit Stops:

1. The position of the car when stopped by each of the normal limit stops with no load and with contract load in the car must be accurately measured.

2. Final position of the elevator relative to the terminal landings must be determined when the elevator has been stopped by the final limits. The lower limit stop must be made with contract load in the elevator. Elevator must be operated at inspection speed for both tests. Normal limit stopping devices must be inoperative for the tests.

J. 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.

K. Test automatic shut-off valve for proper operation.

L. Operating and Signal System: The elevator must be operated by the operating devices provided and the operation signals and automatic floor leveling must function in accordance with requirements specified. Starting, stopping and leveling must be smooth and comfortable without appreciable steps of acceleration or deceleration.

M. Performance of the Elevator supervisory system must be witnessed and approved by the COR.

N. Evidence of malfunction in any tested system or parts of equipment that occurs during the testing must be corrected, repaired, or replaced at no additional cost to the Government and the test repeated.

O. If equipment fails test requirements and a re-inspection is required, the Contractor must be responsible for the cost of re-inspection; salaries, transportation expenses and per-diem expenses incurred by the representative of the Contracting Officer.

3.7 INSTRUCTION TO VA PERSONNEL

A. 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 workday. Instruction must commence after completion of all work and at the time and place directed by the VA COR or authorized representative.

B. Written instructions in triplicate relative to care, adjustments and operation of all equipment and accessories must be furnished and delivered to the RE/CO or authorized representative in independently bound folders. DVD recordings will also be acceptable. Written instructions must 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 with descriptive literature and identification and diagrammatic cuts of equipment and parts. Information must also include electrical operation characteristics of all circuits, relays, timers and electronic devices, as well as rpm values and related characteristics for all rotating equipment.

C. 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".

3.8 ELEVATOR GUARANTEE PERIOD OF SERVICE: MAINTENANCE SERVICE AND INSPECTIONS

A. Provide complete maintenance service and inspections during the modernization period for all elevators and on each elevator for one (1) year after completion and acceptance of each elevator in this specification by the Resident Engineer or Contracting Officer. This maintenance service must run concurrently with the warranty. Maintenance work must be performed by Certified Elevator Mechanics and Apprentices.

B. This contract will cover full maintenance including emergency call back service, inspections and servicing the elevators listed in the schedule of elevator. The Elevator Contractor must be required to perform the following:

1. Monthly systematic examination of equipment.
2. During each maintenance visit the Elevator Contractor must clean, lubricate, adjust, repair and replace all parts as necessary to keep the equipment in first class condition and proper working order.
3. Furnishing all lubricant, cleaning materials, parts and tools necessary to perform the work required. Lubricants must be only those products recommended by the manufacturer of the equipment.
4. As required, motors, controllers, selectors, leveling devices, operating devices, switches on cars and in hoistways, hoistway doors and car doors or gate operating device, interlock contacts, guide shoes, guide rails, car door sills, hangers for doors, car doors or gates and signal system must be cleaned, lubricated and adjusted.
5. Guide rails and bottom of platforms must be cleaned every three months. Car tops and machine room floors must be cleaned monthly. Accumulated rubbish must be removed from the pits monthly. A general cleaning of the entire installation including all machine room

equipment and hoistway equipment must be accomplished quarterly. Cleaning supplies and vacuum cleaner must be furnished by the Contractor.

6. Maintain the performance standards set forth in this specification.
7. The operational system must be maintained to the standards specified hereinafter including any changes or adjustments required to meet varying conditions of hospital occupancy.
8. Maintain smooth starting and stopping and accurate leveling always.

C. Maintenance service must not include the performance of work required because of improper use, accidents and negligence for which the Elevator Contractor is not directly responsible.

D. Provide 24-hour emergency call-back service that must consist of promptly responding to calls within two hours for emergency service should a shutdown or emergency develop between regular examinations. Overtime emergency call-back service must be limited to minor adjustments and repairs required to protect the immediate safety of the equipment and persons in and about the elevator.

E. Service and emergency personnel must report to the Contracting Officer or his authorized representative upon arrival at the hospital and again upon completion of the required work. A copy of the work ticket containing a complete description of the work performed must be given to the VA COR.

F. The Elevator Contractor must maintain a logbook in the machine room.

SECTION 22 05 11
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section will apply to all sections of Division 22.

B. Definitions:

1. Exposed: Piping and equipment exposed to view in finished rooms.
2. Exterior: Piping and equipment exposed to weather be it temperature, humidity, precipitation, wind or solar radiation.

C. Abbreviations/Acronyms:

1. ACR: Air Conditioning and Refrigeration
2. A/E: Architect/Engineer
3. AFF: Above Finish Floor
4. AFG: Above Finish Grade
5. AI: Analog Input
6. AO: Analog Output
7. ASHRAE: American Society of Heating Refrigeration, Air Conditioning Engineers
8. ASME: American Society of Mechanical Engineers
9. ASPE: American Society of Plumbing Engineers
10. BACnet: Building Automation and Control Network
11. bhp: Brake Horsepower
12. Btu: British Thermal Unit
13. Btu/h: British Thermal Unit per Hour
14. CFM: Cubic Feet per Minute
15. CI: Cast Iron
16. CLR: Color
17. CO: Contracting Officer
18. COR: Contracting Officer’s Representative
19. CPVC: Chlorinated Polyvinyl Chloride
20. db(A): Decibels (A weighted)
21. DDC: Direct Digital Control
22. DI: Digital Input
23. DO: Digital Output
24. DWG: Drawing

25. DWV: Drainage, Waste and Vent
26. ECC: Engineering Control Center
27. EL: Elevation
28. F: Fahrenheit
29. FAR: Federal Acquisition Regulations
30. FED: Federal
31. FG: Fiberglass
32. FNPT: Female National Pipe Thread
33. FU: Fixture Units
34. GAL: Gallon
35. GPD: Gallons per Day
36. GPH: Gallons per Hour
37. GPM: Gallons per Minute
38. HEFP: Healthcare Environment and Facilities Program (replacement for OCAMES)
39. HP: Horsepower
40. Hz: Hertz
41. ID: Inside Diameter
42. INV: Invert
43. IPC: International Plumbing Code
44. IW: Indirect Waste
45. KW: Kilowatt
46. KWH: Kilowatt Hour
47. lb: Pound
48. lbs/hr: Pounds per Hour
49. L/min: Liters per Minute
50. L/s: Liters per Second
51. m: Meter
52. MA: Medical Air
53. MAWP: Maximum Allowable Working Pressure
54. MAX: Maximum
55. MED: Medical
56. MER: Mechanical Equipment Room
57. MFG: Manufacturer
58. NC: Normally Closed
59. NG: Natural Gas

60. NIC: Not in Contract
61. NO: Normally Open
62. NOM: Nominal
63. NPTF: National Pipe Thread Female
64. NPS: Nominal Pipe Size
65. NPT: Nominal Pipe Thread
66. NTS: Not to Scale
67. OC: On Center
68. OD: Outside Diameter
69. PD: Pressure Drop or Difference
70. PDI: Plumbing and Drainage Institute
71. PP: Polypropylene
72. ppb: Parts per Billion
73. ppm: Parts per Million
74. PSI: Pounds per Square Inch
75. PSIA: Pounds per Square Inch Atmosphere
76. PSIG: Pounds per Square Inch Gauge
77. PVC: Polyvinyl Chloride
78. RAD: Radians
79. RPM: Revolutions Per Minute
80. SCFM: Standard Cubic Feet per Minute
81. SMACNA: Sheet Metal and Air Conditioning Contractors National Association
82. SPEC: Specification
83. SQFT/SF: Square Feet
84. SS: Stainless Steel
85. STD: Standard
86. TD: Temperature Difference
87. TDH: Total Dynamic Head
88. TEMP: Temperature
89. THERM: 100,000 Btu
90. TIL: Technical Information Library http//www.cfm.va.gov/til/indes.asp
91. T/P: Temperature and Pressure
92. TYP: Typical
93. USDA: U.S. Department of Agriculture

94. V: Vent
95. V: Volt
96. VA: Veterans Administration
97. VA CFM: VA Construction & Facilities Management
98. VA CFM CSS: VA Construction & Facilities Management, Consulting Support Service
99. VAC: Vacuum
100. VAC: Voltage in Alternating Current
101. VAMC: Veterans Administration Medical Center
102. VHA OCAMES: This has been replaced by HEFP.
103. VSD: Variable Speed Drive
104. VTR: Vent through Roof
105. W: Waste
106. WAGD: Waste Anesthesia Gas Disposal
107. WC: Water Closet
108. WG: Water Gauge
109. WOG: Water, Oil, Gas
110. WPD: Water Pressure Drop
111. WSFU: Water Supply Fixture Units

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
C. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
D. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
E. Section 05 50 00, METAL FABRICATIONS.
F. Section 07 84 00, FIRESTOPPING.
G. Section 07 92 00, JOINT SEALANTS.
H. Section 09 91 00, PAINTING.
I. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.
J. Section 22 07 11, PLUMBING INSULATION.
K. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
L. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
M. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
N. Section 26 29 11, MOTOR CONTROLLERS.

1.3 SUBMITTALS

A. Submittals, including number of required copies, will be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section will be marked "SUBMITTED UNDER SECTION 22 05 11, COMMON WORK RESULTS FOR PLUMBING", with applicable paragraph identification.

C. If the project is phased, contractors will submit complete phasing plan/schedule with manpower levels prior to commencing work. The phasing plan will be detailed enough to provide milestones in the process that can be verified.

D. Contractor will make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements, and all equipment that requires regular maintenance, calibration, etc are accessable from the floor or permanent work platform. It is the Contractor’s responsibility to ensure all submittals meet the VA specifications and requirements and it is assumed by the VA that all submittals do meet the VA specifications unless the Contractor has requested a variance in writing and approved by COR prior to the submittal. If at any time during the project it is found that any item does not meet the VA specifications and there was no variance approval the Contractor will correct at no additional cost or time to the Government even if a submittal was approved.

E. If equipment is submitted which differs in arrangement from that shown, provide documentation proving equivalent performance, design standards and drawings that show the rearrangement of all associated systems. Additionally, any impacts on ancillary equipment or services such as foundations, piping, and electrical will be the Contractor’s responsibility to design, supply, and install at no additional cost or time to the Government. VA approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

F. Prior to submitting shop drawings for approval, Contractor will 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.

G. Submittals and shop drawings for interdependent items, containing applicable descriptive information, will 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 installation. Final review and approvals will be made only by groups.

H. Manufacturer's Literature and Data including: Manufacturer’s literature will be submitted under the pertinent section rather than under this section.
   1. Electric motor data and variable speed drive data will be submitted with the driven equipment.
   2. Equipment and materials identification.
   3. Firestopping materials.
   4. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
   5. Wall, floor, and ceiling plates.

I. Coordination/Shop Drawings:
   1. Submit complete consolidated and coordinated shop drawings for all new systems, and for existing systems that are in the same areas.
   2. The coordination/shop drawings will include plan views, elevations and sections of all systems and will be on a scale of not less than 1:32 (3/8-inch equal to 1 foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings will 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 coordination/shop drawings of all piping and duct systems. The drawings should include all lockout/tagout points for all energy/hazard sources for each piece of equipment. Coordinate lockout/tagout procedures and practices with local VA requirements.
   3. Do not install equipment foundations, equipment or piping until coordination/shop drawings have been approved.

4. In addition, for plumbing systems, provide details of the following:
   a. Mechanical equipment rooms.
   b. Interstitial space.
   c. Hangers, inserts, supports, and bracing.
   d. Pipe sleeves.
   e. Duct or equipment penetrations of floors, walls, ceilings, or roofs.

J. Rigging Plan: Provide documentation of the capacity and weight of the rigging and equipment intended to be used. The plan will include the path of travel of the load, the staging area and intended access, and qualifications of the operator and signal person.

K. Plumbing Maintenance Data and Operating Instructions:
   1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
   2. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
      a. Include complete list indicating all components of the systems.
      b. Include complete diagrams of the internal wiring for each item of equipment.
      c. Diagrams will have their terminals identified to facilitate installation, operation and maintenance.
   3. 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.

L. Provide copies of approved plumbing equipment submittals to the TAB Subcontractor.

1.4 QUALITY ASSURANCE

A. Mechanical, electrical, and associated systems will 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 will 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 will be experienced and qualified specialists in industrial and institutional plumbing.

B. Products Criteria:

1. Standard Products: Material and equipment will be the standard products of a manufacturer regularly engaged in the manufacture, supply and servicing of the specified products for at least 5 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, will be the current generation of technology and basic design that has a proven satisfactory service record of at least 5 years.
2. Equipment Service: There will be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 160 km (100 miles) of the project. These organizations will come to the site and provide acceptable service to restore operations within 4 hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, compressors, water heaters, critical instrumentation, computer workstation and programming will be submitted for project record and inserted into the operations and maintenance manual.
3. All items furnished will be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. The products and execution of work specified in Division 22 will conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official will be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code will apply. Any conflicts will be brought to the attention of the Contracting Officers Representative (COR).

5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units will be of the same manufacturer and model number, or if different models are required they will be of the same manufacturer and identical to the greatest extent possible (i.e., same model series).
6. Assembled Units: Performance and warranty of all components that make up an assembled unit will be the responsibility of the manufacturer of the completed assembly.
7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark will 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.
8. Asbestos products or equipment or materials containing asbestos is prohibited.
9. Bio-Based Materials: For products designated by the USDA’s bio-based Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

C. Welding: Before any welding is performed, Contractor will submit a certificate certifying that welders comply with the following requirements:
1. Qualify welding processes and operators for piping according to ASME BPVC, Section IX, "Welding and Brazing Qualifications". Provide proof of current certification to CO.
2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
3. Certify that each welder and welding operator has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
4. All welds will be stamped according to the provisions of the AWS or ASME as required herein and by the association code.

D. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of

these recommendations will be furnished to the COR prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

E. Execution (Installation, Construction) Quality:

1. All items will be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract documents will be referred to the COR for resolution. Printed copies or electronic files of manufacturer’s installation instructions will be provided to the COR at least 10 working days prior to commencing installation of any item.
2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, will be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include but are not limited to: all types of valves, filters and strainers, transmitters, and control devices. Prior to commencing installation work, refer conflicts between this requirement and contract documents to COR for resolution. Failure of the Contractor to resolve or call attention to any discrepancies or deficiencies to the COR will result in the Contractor correcting at no additional cost or time to the Government.
3. Complete layout drawings will be required by Paragraph, SUBMITTALS. Construction work will not start on any system until the layout drawings have been approved by VA.
4. Installer Qualifications: Installer will be licensed and will provide evidence of the successful completion of at least five projects of equal or greater size and complexity. Provide tradesmen skilled in the appropriate trade.
5. Workmanship/craftsmanship will be of the highest quality and standards. The VA reserves the right to reject any work based on poor quality of workmanship this work will be removed and done again at no additional cost or time to the Government.

F. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with current telephone numbers and e-mail addresses.

G. Guaranty: Warranty of Construction, FAR clause 52.246-21.

H. Plumbing Systems: IPC, International Plumbing Code. Unless otherwise required herein, perform plumbing work in accordance with the latest version of the IPC. For IPC codes referenced in the contract documents, advisory provisions will be considered mandatory, the word “should” will be interpreted as “will”. Reference to the “code official” or “owner” will be interpreted to mean the COR.

I. Cleanliness of Piping and Equipment Systems:

1. Care will be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping will be removed.
2. Piping systems will be flushed, blown or pigged as necessary to deliver clean systems.
3. The interior of all tanks will be cleaned prior to delivery and beneficial use by the Government. All piping will be tested in accordance with the specifications and the International Plumbing Code (IPC). All filters, strainers, fixture faucets will be flushed of debris prior to final acceptance.
4. Contractor will be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.5 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site will 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 or theft.
2. Damaged equipment will be replaced with an identical unit as determined and directed by the COR. Such replacement will be at no additional cost or additional time to the Government.
3. Interiors of new equipment and piping systems will be protected against entry of foreign matter. Both inside and outside will be cleaned before painting or placing equipment in operation.

4. Existing equipment and piping being worked on by the Contractor will be under the custody and responsibility of the Contractor and will be protected as required for new work.
5. Protect plastic piping and tanks from ultraviolet light (sunlight) while in pre-construction. Plastic piping and tanks will not be installed exposed to sunlight without metal jacketing to block ultraviolet rays.

1.6 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, VA approved substitutions and construction revisions will be inserted into a three—ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation will be included in the operation and maintenance manual. The operations and maintenance manual will include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices will be included. A List of recommended spare parts (manufacturer, model number, and quantity) will be furnished. Information explaining any special knowledge or tools the owner will be required to employ will be inserted into the As-Built documentation.

C. The installing Contractor will maintain as-built drawings of each completed phase for verification; and, will provide the complete set at the time of final systems certification testing. Should the installing Contractor engage the testing company to provide as-built or any portion thereof, it will not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:

1. As-built drawings are to be provided, with a copy of them on AutoCAD version. The CAD drawings will use multiple line layers with a separate individual layer for each system.
2.

D. The as-built drawings will indicate the location and type of all lockout/tagout points for all energy sources for all equipment and

pumps to include breaker location and numbers, valve tag numbers, etc. Coordinate lockout/tagout procedures and practices with local VA requirements.

E. Certification documentation will be provided to COR 21 working days prior to submitting the request for final inspection. The documentation will include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results will contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results will include all readings, including but not limited to data on device (make, model and performance characteristics_), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

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 VAMC.

B. Maintenance of Service: Schedule all work to permit continuous service as required by the VAMC.

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 VAMC. These non-critical periods are limited to between 8 pm and 5 am in the appropriate off-season (if applicable). Provide at least 10 working days advance notice to the COR. The request will include a detailed plan on the proposed shutdown and the intended work to be done along with manpower levels. All equipment and materials must be onsite and verified with plan 5/work days prior to the shutdown or it will need to be rescheduled.

D. Phasing of Work: Comply with all requirements shown on contract documents. Contractor will submit a complete detailed phasing plan/schedule with manpower levels prior to commencing work. The

phasing plan will be detailed enough to provide milestones in the process that can be verified.

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. Storm water or ground water leakage is prohibited. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all equipment being operated by VA. Maintain all egress routes and safety systems/devices.

F. Acceptance of Work for Government Operation: As new equipment, systems and facilities are made available for operation and these items are deemed of beneficial use to the Government, inspections 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 MATERIALS FOR VARIOUS SERVICES

A. Material or equipment containing a weighted average of greater than 0.25 percent lead will not be used in any potable water system intended for human consumption and will be certified in accordance with NSF 61 or NSF 372.

B. In-line devices such as water meters, building valves, check valves, stops, valves, fittings, tanks and backflow preventers will comply with NSF 61 and NSF 372.

C. End point devices such as drinking fountains, lavatory faucets, kitchen and bar faucets, ice makers supply stops, and end-point control valves used to dispense drinking water must meet requirements of NSF 61 and NSF 372.

2.2 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components will be maximized to reduce spare part requirements.

B. Manufacturers of equipment assemblies that include components made by others will 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 will be products of a single manufacturer.
   3. Components will be compatible with each other and with the total assembly for intended service.
   4. Contractor will guarantee performance of assemblies of components and will repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly at no additional cost or time to the Government.

C. Components of equipment will 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, will be the same make and model.

2.3 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed will 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 system that conforms to contract requirements.

2.4 SAFETY GUARDS

A. Pump shafts and couplings will be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material will be minimum 16-gauge sheet steel; ends will be braked and drilled and attached to pump base with minimum of four 8 mm (1/4 inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

B. B. All Equipment will have moving parts protected from personal injury.

2.5 LIFTING ATTACHMENTS

A. Equipment will be provided with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments will withstand any handling conditions that might be encountered, without

bending or distortion of shape, such as rapid lowering and braking of load.

2.6 ELECTRIC MOTORS, MOTOR CONTROL, CONTROL WIRING

A. All material and equipment furnished and installation methods used will conform to the requirements of Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT; Section 26 29 11, MOTOR CONTROLLERS; and, Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. All electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems will be provided. Premium efficient motors will be provided. Unless otherwise specified for a particular application, electric motors will have the following requirements.

B. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 at no additional cost or time to the Government.
2. Assemblies of motors, starters, and controls and interlocks on factory assembled and wired devices will be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications will be modified as follows:
   a. Wiring material located where temperatures can exceed 71° C (160° F) will be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers and water heaters.
   b. Other wiring at boilers and water heaters, and to control panels, will be NFPA 70 designation THWN.
   c. Shielded conductors or wiring in separate conduits for all instrumentation and control systems will be provided where recommended by manufacturer of equipment.
4. Motor sizes will be selected so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps will be sized for non-overloading at all points on the pump performance curves.
5. Motors utilized with variable frequency drives will be rated “inverter-ready” per NEMA Standard, MG1.

C. Motor Efficiency and Power Factor: All motors, when specified as “high efficiency or Premium Efficiency” by the project specifications on driven equipment, will conform to efficiency and power factor requirements in Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT, with no consideration of annual service hours. Motor manufacturers generally define these efficiency requirements as “NEMA premium efficient” and the requirements generally exceed those of the Energy Policy Act (EPACT), revised 2005. Motors not specified as “high efficiency or premium efficient” will comply with EPACT.

D. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal pumps may be split phase or permanent split capacitor (PSC).

E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor will have two separate windings. A time delay (20 seconds minimum) relay will be provided for switching from high to low speed.

F. Rating: Rating will be continuous duty at 100 percent capacity in an ambient temperature of 40° C (104° F); minimum horsepower as shown on drawings; maximum horsepower in normal operation will not exceed nameplate rating without service factor.

G. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame will be measured at the time of final inspection.

2.7 VARIABLE SPEED MOTOR CONTROLLERS

A. Refer to Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 26 29 11, MOTOR CONTROLLERS for specifications.

B. The combination of controller and motor will be provided by the respective pump manufacturer and will be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. pumps, will be product of a single manufacturer.

C. Motors will be premium efficient type, “invertor duty”, and be approved by the motor controller manufacturer. The controller-motor combination will be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor sheaves will be fixed pitch.

D. Controller will not add any current or voltage transients to the input AC power distribution system, DDC controls, sensitive medical

equipment, etc., nor will be affected from other devices on the AC power system.

2.8 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown in the drawings, or shown in the maintenance manuals. Coordinate equipment and valve identification with local VAMC shops. In addition, provide bar code identification nameplate for all equipment which will allow the equipment identification code to be scanned into the system for maintenance and inventory tracking. Identification for piping is specified in Section 09 91 00, PAINTING.

B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 7 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 will be permanently fastened to the equipment. Unit components such as water heaters, tanks, coils, filters, etc. will be identified.

C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 7 mm (3/16 inch) high riveted or bolted to the equipment.

D. Control Items: All temperature, pressure, and controllers will be labeled and the component’s function identified. Identify and label each item as they appear on the control diagrams.

E. Valve Tags and Lists:

1. Plumbing: All valves will be provided with valve tags and listed on a valve list (Fixture stops not included).
2. 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 gauge, 40 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
3. Valve lists: Valve lists will be created using a word processing program and printed on plastic coated cards. The plastic-coated valve list card(s), sized 215 mm (8-1/2 inches) by 275 mm (11 inches) will show valve tag number, valve function and area of control for each service or system. The valve list will be in a punched 3-ring binder notebook. An additional copy of the valve list will be mounted in picture frames for mounting to a wall. COR will instruct Contractor where frames will be mounted.

4. A detailed plan for each floor of the building indicating the location and valve number for each valve will be provided in the 3-ring binder notebook. Each valve location will be identified with a color-coded sticker or thumb tack in ceiling or access door.

2.9 FIRESTOPPING

A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping. Refer to Section 22 07 11, PLUMBING INSULATION, for pipe insulation.

2.10 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. In lieu of the paragraph which follows, suspended equipment support and restraints may be designed and installed in accordance with the International Building Code (IBC Submittals based on the International Building Code (IBC requirements, or the following paragraphs of this Section will be stamped and signed by a professional engineer registered in the state where the project is located. The Support system of suspended equipment over 227 kg (500 pounds) will be submitted for approval of the COR in all cases. See the above specifications for lateral force design requirements.

B. Type Numbers Specified: For materials, design, manufacture, selection, application, and installation refer to MSS SP-58. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.

C. For Attachment to Concrete Construction:
   1. Concrete insert: Type 18, MSS SP-58.
   2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 100 mm (4 inches) thick when approved by the COR for each job condition.
   3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 100 mm (4 inches) thick when approved by the COR for each job condition.

D. For Attachment to Steel Construction: MSS SP-58.
   1. Welded attachment: Type 22.
   2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8 inch) outside diameter.

E. Attachment to Metal Pan or Deck: As required for materials specified in Section 05 31 00, STEEL DECKING.

F. For Attachment to Wood Construction: Wood screws or lag bolts.

G. Hanger Rods: Hot-rolled steel, ASTM A36/A36M or ASTM 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 will provide 40 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

H. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 43 mm by 43 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gauge), designed to accept special spring held, hardened steel nuts.

1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
2. Guide individual pipes on the horizontal member of every other trapeze hanger with 8 mm (1/4 inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 15 mm (1/2 inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.

I. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 22 07 11, PLUMBING INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium silicate shield at all other types of supports and hangers including those for insulated piping.

1. General Types (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.
   g. U-bolt clamp: Type 24.
   h. Copper Tube:
      1) Hangers, clamps and other support material in contact with tubing will be painted with copper colored epoxy paint,

copper-coated, plastic coated or taped with isolation tape to prevent electrolysis.

2) For vertical runs use epoxy painted, copper-coated 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 1 inch beyond steel support or clamp.

j. Spring hangers are required on all plumbing system pumps one horsepower and greater.

2. Plumbing Piping (Other Than General Types):

a. Horizontal piping: Type 1, 5, 7, 9, and 10.

b. Chrome plated piping: Chrome plated supports.

c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.

d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gauge) minimum.

J. Pre-insulated Calcium Silicate Shields:

1. Provide 360-degree water resistant high density 965 kPa (140 psig) 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 will 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 cold water will have insulation that extends a minimum of 25 mm (1 inch) past the sheet metal.

b. The insulated calcium silicate shield will support the maximum allowable water filled span as indicated in MSS SP-58. To support

the load, the shields will have one or more of the following features: structural inserts 4138 kPa (600 psig) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36/A36M) wear plates welded to the bottom sheet metal jacket.

5. Shields may be used on steel clevis hanger type supports, trapeze hangers, roller supports or flat surfaces.

K. Seismic Restraint of Piping: Refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

2.11 PIPE PENETRATIONS

A. Pipe penetration sleeves will be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.

B. Pipe penetration sleeve materials will comply with all firestopping requirements for each penetration.

C. To prevent accidental liquid spills from passing to a lower level, provide the following:

1. For sleeves: Extend sleeve 25 mm (1 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.

D. Penetrations are prohibited through beams or ribs, but may be installed in concrete beam flanges, with structural engineer prior approval. Any deviation from these requirements must receive prior approval of COR.

E. Sheet metal, plastic, or moisture resistant fiber sleeves will be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

F. Cast iron or zinc coated pipe sleeves will be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe will be made watertight with a modular or link rubber seal. The link seal will be applied at both ends of the sleeve.

G. Galvanized steel or an alternate black iron pipe with asphalt coating sleeves will be for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel sleeve will

be provided for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, sleeves will be connected with a floor plate.

H. Brass Pipe Sleeves will be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve will be connected with a floor plate.

I. Sleeve clearance through floors, walls, partitions, and beam flanges will be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation will be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. Interior openings will be caulked tight with firestopping material and sealant to prevent the spread of fire, smoke, water and gases.

J. Sealant and Adhesives: Will be as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials will be utilized when possible.

K. Pipe passing through roof will be installed through a 4.9 kg per square meter copper flashing with an integral skirt or flange. Skirt or flange will extend not less than 200 mm (8 inches) from the pipe and set in a solid coating of bituminous cement. Extend flashing a minimum of 250 mm (10 inches) up the pipe. Pipe passing through a waterproofing membrane will be provided with a clamping flange. The annular space between the sleeve and pipe will be sealed watertight.

2.12 TOOLS AND LUBRICANTS

A. Furnish, and turn over to the COR, special 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. Tool Containers: metal, permanently identified for intended service and mounted, or located, where directed by the COR.

D. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application. Bio-based materials will be utilized when possible.

2.13 ASBESTOS

A. Materials containing asbestos are prohibited.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions will be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment will be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings will be prepared to coordinate proper location and personnel access of all facilities. The drawings will be submitted for review.

B. Manufacturer's published recommendations will be followed for installation methods not otherwise specified.

C. Operating Personnel Access and Observation Provisions: All equipment and systems will be arranged to provide clear view and easy access, without use of portable ladders, for maintenance, testing and operation of all devices including, but not limited to: all equipment items, valves, backflow preventers, filters, strainers, transmitters, sensors, meters and control devices. All gauges and indicators will be clearly visible by personnel standing on the floor or on permanent platforms. Maintenance and operating space and access provisions that are shown in the drawings will not be changed nor reduced.

D. Structural systems necessary for pipe and equipment support will be coordinated to permit proper installation.

E. Location of pipe sleeves, trenches and chases will be accurately coordinated with equipment and piping locations.

F. Cutting Holes:

1. Holes will be located to avoid interference with structural members such as beams or grade beams. Holes will 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 will be referred to COR for approval.
2. Waterproof membrane will not be penetrated. Pipe floor penetration block outs will be provided outside the extents of the waterproof membrane.
3. Holes through concrete and masonry will be cut 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.

G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other services are not shown but must be provided.

H. Protection and Cleaning:

1. Equipment and materials will 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, will be replaced at no additional cost or time to the Government.
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. Pipe openings, equipment, and plumbing fixtures will be tightly covered against dirt or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

I. Concrete and Grout: Concrete and shrink compensating grout 25 MPa (3000 psig) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE, will be used for all pad or floor mounted equipment.

J. Gauges, thermometers, valves and other devices will be installed with due regard for ease in reading or operating and maintaining said devices. Thermometers and gauges will be located and positioned to be easily read by operator or staff standing on floor or walkway provided. Servicing will not require dismantling adjacent equipment or pipe work.

K. Interconnection of Controls and Instruments: Electrical interconnection is generally not shown but will be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, alarms, instruments and computer workstations. Comply with NFPA 70.

L. Domestic cold and hot water systems interface with the HVAC control system for the temperature, pressure and flow monitoring requirements to mitigate legionella. See the HVAC control points list and Section 23 09 23, DIRECT DIGITAL CONTROL SYSTEM FOR HVAC.

M. Work in Existing Building:
   1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
   2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will cause the least interfere with normal operation of the facility.

N. Work in Animal Research Areas: Seal all pipe penetrations with silicone sealant to prevent entrance of insects.

O. Work in bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons will be sealed with plumbers’ putty.

P. Switchgear Drip Protection: Every effort will be made to eliminate the installation of pipe above data equipment, and electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Drain valve will be provided in low point of casement pipe.

Q. Inaccessible Equipment:
   1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment will be removed and reinstalled or remedial action performed as directed at no additional cost or additional time 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 electrical conduit, 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 may require temporary installation or relocation of equipment and piping. Temporary equipment or pipe installation or relocation will be provided to maintain continuity of operation of existing facilities.

B. The Contractor will provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All

piping and equipment will be properly supported, sloped to drain, operate without excessive stress, and will be insulated where injury can occur to personnel by contact with operating facilities. The requirements of paragraph 3.1 will apply.

C. Temporary facilities and piping will be completely removed back to the nearest active distribution branch or main pipe line and any openings in structures sealed. Dead legs are prohibited in potable water systems. Necessary blind flanges and caps will be provided to seal open piping remaining in service.

3.3 RIGGING

A. Openings in building structures will be planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered and will be considered by Government under specified restrictions of phasing and service requirements as well as structural integrity of the building.

C. All openings in the building will be closed when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.

D. Contractor will provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures will be Contractor's full responsibility.

E. Contractor will check all clearances, weight limitations and will provide a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, will be at Contractor's cost, time and responsibility.

F. Rigging plan and methods will be referred to COR for evaluation prior to actual 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. Holes will be drilled or burned in structural steel ONLY with the prior written approval of the COR.

B. The use of chain pipe supports, wire or strap hangers; wood for blocking, stays and bracing, or hangers suspended from piping above will not be permitted. Rusty products will be replaced.

C. Hanger rods will be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. A minimum of 15 mm (1/2 inch) clearance between pipe or piping covering and adjacent work will be provided.

D. For horizontal and vertical plumbing pipe supports, refer to the International Plumbing Code (IPC) and these specifications.

E. 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 will be supported in channel troughs.

F. Floor Supports:

1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems will be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
2. Bases and supports will not be located and installed until equipment mounted thereon has been approved. Bases will be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Structural drawings will be reviewed for additional requirements. Bases will be neatly finished and smoothed, will have chamfered edges at the top, and will be suitable for painting.
3. All equipment will be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts will be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a grout material to permit alignment and realignment.
4. For seismic anchoring, refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.5 LUBRICATION

A. All equipment and devices requiring lubrication will be lubricated prior to initial operation. All devices and equipment will be field checked for proper lubrication.

B. All devices and equipment will be equipped with required lubrication fittings. A minimum of 1 liter (1 quart) of oil and 0.45 kg (1 pound) of grease of manufacturer's recommended grade and type for each different application will be provided. All materials will be delivered to COR in unopened containers that are properly identified as to application.

C. A separate grease gun with attachments for applicable fittings will be provided for each type of grease applied.

D. All lubrication points will be accessible without disassembling equipment, except to remove access plates.

E. All lubrication points will be extended to one side of the equipment.

3.6 PLUMBING SYSTEMS DEMOLITION

A. Rigging access, other than indicated in the drawings, will be provided after approval for structural integrity by the COR. Such access will be provided at no additional cost or time to the Government. Where work is in an operating plant, approved protection from dust and debris will be provided at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.

B. In an operating plant, cleanliness and safety will be maintained. The plant will be kept in an operating condition. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Work will be confined to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Dust and debris will not be permitted to accumulate in the area to the detriment of plant operation. All flame cutting will be performed to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities will be available at all times. All work will be performed in accordance with recognized fire protection standards including NFPA 51B. Inspections will be made by personnel of the VAMC, and the Contractor will follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.

C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work will be completely removed from Government property per Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT. This includes all concrete equipment pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings will be sealed 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 will be maintained. Reference will 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 gauges and thermometers with wells will remain Government property and will be removed and delivered to COR and stored as directed. The Contractor will remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material will be removed from Government property expeditiously and will not be allowed to accumulate. Coordinate with the COR and Infection Control.

3.7 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 will be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

B. In addition, the following special conditions apply:

1. Cleaning will be thorough. Solvents, cleaning materials and methods recommended by the manufacturers will be used for the specific tasks. All rust will be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions will be repaired prior to applying prime and finish coats.
2. The following Material and Equipment will NOT be painted:
   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 will be cleaned and damaged surfaces repaired. Touch-up painting will be made with matching paint type and color obtained from manufacturer or computer matched.
4. Pumps, motors, steel and cast-iron bases, and coupling guards will be cleaned, and will be touched-up with the same paint type and color as utilized by the pump manufacturer.
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats per Section 09 91 00, Painting.
6. The final result will be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment will be repainted, if necessary, to achieve this. Lead based paints will not be used.

3.8 IDENTIFICATION SIGNS

A. Laminated plastic signs, with engraved lettering not less than 7 mm (3/16 inch) high, will be provided that designates equipment function, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols will 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, and performance data will be placed on factory-built equipment.

C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

3.9 STARTUP AND TEMPORARY OPERATION

A. Startup of equipment will be performed as described in the equipment specifications. Vibration within specified tolerance will be verified prior to extended operation. Temporary use of equipment is specified in

Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.10 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, all required tests will be performed as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS 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 systems occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then conduct such performance tests and finalize control settings during the first actual seasonal use of the respective systems following completion of work. Rescheduling of these tests will be requested in writing to COR for approval.

3.11 OPERATION AND MAINTENANCE MANUALS

A. All new and temporary equipment and all elements of each assembly will be included.

B. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information will be included.

C. Manufacturer’s installation, maintenance, repair, and operation instructions for each device will be included. Assembly drawings and parts lists will also be included. A summary of operating precautions and reasons for precautions will be included in the Operations and Maintenance Manual.

D. Lubrication instructions, type and quantity of lubricant will be included.

E. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications will be included.

F. Set points of all interlock devices will be listed.

G. Trouble-shooting guide for the control system troubleshooting will be inserted into the Operations and Maintenance Manual.

H. The control system sequence of operation corrected with submittal review comments will be inserted into the Operations and Maintenance Manual.

I. Emergency procedures for shutdown and startup of equipment and systems.

3.12 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

- - - E N D - - -

SECTION 22 05 12
GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the general motor requirements for plumbing equipment and applies to all sections of Division 22.

B. A complete listing of common acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

E. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

F. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

G. Section 26 29 11, MOTOR CONTROLLERS: Starters, control and protection of motors.

1.3 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. Where conflicts occur these specifications and VHA standard will govern.

B. American Bearing Manufacturers Association (ABMA):

ABMA 9–2015.....Load Ratings and Fatigue Life for Ball Bearings

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

112-2017.....IEEE Standard Test Procedure for Polyphase Induction Motors and Generators

841-2018.....IEEE Standard for Petroleum and Chemical Industry-Premium-Efficiency, Severe-Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors--Up to and Including 370 kW (500 HP)

D. International Code Council (ICC):

IPC-2018.....International Plumbing Code

E. National Electrical Manufacturers Association (NEMA):

MG 1-2016.....Motors and Generators

MG 2-2014.....Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators

250-2018.....Enclosures for Electrical Equipment (1000 Volts Maximum)

F. National Fire Protection Association (NFPA):

70-2020.....National Electrical Code (NEC)

1.4 **SUBMITTALS**

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT”, with applicable paragraph identification.

C. Submit motor submittals with drive equipment.

D. Shop Drawings:

1. Provide documentation to demonstrate compliance with contract documents.
2. Motor nameplate information shall be submitted including electrical ratings, efficiency, bearing data, power factor, frame size, dimensions, mounting details, materials, horsepower, voltage, phase, speed (RPM), enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.
3. Motor parameters required for the determination of the Reed Critical Frequency of vertical hollow shaft motors shall be submitted.

E. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. iagrams shall have their terminals identified to facilitate installation, operation and maintenance.

G. Certification: Two weeks prior to final inspection, unless otherwise noted, the following certification shall be submitted to the Contracting Officer’s Representative (COR).
   1. Certification shall be submitted stating that the motors have been properly applied, installed, adjusted, lubricated, and tested.

1.5 **QUALITY ASSURANCE**

A. Bio-Based Materials: For products designated by the USDA’s bio-based Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

B. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 **AS-BUILT DOCUMENTATION**

A. Comply with requirements in Paragraph “AS-BUILT DOCUMENTATION” of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

2.1 **MOTORS**

A. All material and equipment furnished and installation methods shall conform to the requirements of Section 26 29 11, MOTOR CONTROLLERS; and Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide premium efficiency type motors.

Unless otherwise specified for a particular application, use electric motors with the following requirements.

B. For alternating current, fractional and integral horsepower motors, NEMA MG 1 and NEMA MG 2 shall apply.

C. For severe duty totally enclosed motors, IEEE 841 shall apply. For severe duty totally enclosed motors, IEEE 841 shall apply.

D. Single-phase Motors: Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC) type. Provide capacitor-start type for hard starting applications.

E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type.

1. Two Speed Motors: Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.

F. Voltage ratings shall be as follows:

1. Single phase:

a. Motors connected to 120-volt systems: 115 volts.

G. Number of phases shall be as follows:

1. Motors, less than 373 W (1/2 HP): Single phase.
2. Exceptions:

a. Hermetically sealed motors.
b. Motors for equipment assemblies, less than 746 W (1 HP), may be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.

H. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.

I. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting, acceleration and running torque without exceeding nameplate ratings or considering service factor.

J. Motor Enclosures:

1. Shall be the NEMA types as specified and/or shown in the Contract Documents.

2. Where the types of motor enclosures are not shown in the drawings, they shall be the NEMA types per NEMA 250, which are most suitable for the environmental conditions where the motors are being installed. Enclosure requirements for certain conditions are as follows:
   a. Motors located outdoors, indoors in wet or high humidity locations, or in unfiltered airstreams shall be totally enclosed type.
   b. Where motors are located in an NEC 511 classified area, provide TEFC explosion proof motor enclosures.
   c. Where motors are located in a corrosive environment, provide TEFC enclosures with corrosion resistant finish.
3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.

K. Electrical Design Requirements:
1. Motors shall be continuous duty.
2. The insulation system shall be rated minimum of Class B, 130 degrees C (266 degrees F).
3. The maximum temperature rise by resistance at rated power shall not exceed Class B limits, 80 degrees C (144 degrees F).
4. The speed/torque and speed/current characteristics shall comply with NEMA Design A or B, as specified.
5. Motors shall be suitable for full voltage starting, unless otherwise noted. Coordinate motor features with applicable motor controllers.
6. Motors for variable frequency drive applications shall adhere to NEMA MG 1, Part 30, Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable Voltage or Adjustable Frequency Controls, or both, or NEMA MG 1, Part 31, Definite Purpose Inverter Fed Polyphase Motors.

L. Mechanical Design Requirements:
1. Bearings shall be rated for a minimum fatigue life of 26,280 hours for belt-driven loads and 100,000 hours for direct-drive loads based on L10 (Basic Rating Life) at full load direct coupled, except vertical high thrust motors which require a

40,000 hour rating. A minimum fatigue life of 40,000 hours is required for VFD drives.

2. Vertical motors shall be capable of withstanding a momentary up thrust of at least 30 percent of normal down thrust.
3. Grease lubricated bearings shall be designed for electric motor use. Grease shall be capable of the temperatures associated with electric motors and shall be compatible with Polyurea based greases.
4. Grease fittings, if provided, shall be Alemite type or equivalent.
5. Oil lubricated bearings, when specified, shall have an externally visible sight glass to view oil level.
6. Vibration shall not exceed 3.8 mm (0.15 inch) per second, unfiltered peak.
7. Noise level shall meet the requirements of the application.
8. Motors on 180 frames and larger shall have provisions for lifting eyes or lugs capable of a safety factor of 5.
9. All external fasteners shall be corrosion resistant.
10. Condensation heaters, when specified, shall keep motor windings at least 5 degrees C (9 degrees F) above ambient temperature.
11. Winding thermostats, when specified shall be normally closed, connected in series.
12. Grounding provisions shall be in the main terminal box.

M. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional cost or time to the Government.
2. Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
   a. Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with

Teflon FEP insulation with jacket. This includes wiring on the boilers.

b. Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.

c. Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.

4. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.

5. Motors utilized with variable frequency drives shall be rated “inverter-duty” per NEMA MG 1, Part 31, Definite-Purpose Inverter-Fed Polyphase Motors. Provide motor shaft grounding apparatus that will protect bearings from damage from stray currents.

N. Additional requirements for specific motors, as indicated in other sections, shall also apply.

O. NEMA Premium Efficiency Electric Motors, Motor Efficiencies: All permanently wired polyphase motors of 746 W (1 HP) or greater shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 746 W (1 HP) or greater with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Efficiencies Open Drip-Proof				Minimum Efficiencies Totally Enclosed Fan-Cooled			
Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM	Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%
149.2 (200)	95.4%	95.8%	95.0%	149.2 (200)	95.8%	96.2%	95.4%

P. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM. Power factor correction capacitors shall be provided unless the motor meets the 0.9 requirement without it or if the motor is controlled by a variable frequency drive. The power factor correction capacitors shall be able to withstand high voltage transients and power line variations without breakdown.

Q. Energy Efficiency of Small Motors (Motor Efficiencies): All motors under 746 W (1 hp) shall meet the requirements of the DOE Small Motor Regulation.

Polyphase Open Motors Average full load efficiency				Capacitor-start capacitor-run and capacitor-start induction run open motors Average full load efficiency			
Rating kW (hp)	**6 poles**	**4 poles**	**2 poles**	**Rating kW (hp)**	**6 poles**	**4 poles**	**2 poles**
0.18 (0.25)	67.5	69.5	65.6	0.18 (0.25)	62.2	68.5	66.6
0.25 (0.33)	71.4	73.4	69.5	0.25 (0.33)	66.6	72.4	70.5
0.37 (0.5)	75.3	78.2	73.4	0.37 (0.5)	76.2	76.2	72.4
0.55 (0.75)	81.7	81.1	76.8	0.55 (0.75)	80.2	81.8	76.2

PART 3 - EXECUTION

3.1 **INSTALLATION**

A. Install motors in accordance with manufacturer’s recommendations, the NEC, NEMA, as shown in the drawings and/or as required by other sections of these specifications.

B. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 **FIELD TESTS**

A. All tests shall be witnessed by the CxA or by the COR.

B. Perform an electric insulation resistance Test using a megohmmeter on all motors after installation, before startup. All shall test free from grounds.

C. Perform Load test in accordance with IEEE 112, Test Method B, to determine freedom from electrical or mechanical defects and compliance with performance data.

D. Insulation Resistance: Not less than 1/2 meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

E. All test data shall be complied into a report form for each motor and provided to the contracting officer or their representative.

3.3 **STARTUP AND TESTING**

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed

simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

3.4 **DEMONSTRATION AND TRAINING**

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

- - - E N D - - -

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.

B. A complete listing of common acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D.

E. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 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. Where conflicts occur these specifications and the VHA standard will govern.

B. American Society of Mechanical Engineers (ASME):
A112.14.1-2003.....Backwater Valves

C. American Society of Sanitary Engineering (ASSE):
1001-2017.....Performance Requirements for Atmospheric Type Vacuum Breakers
1003-2009.....Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems
1011-2017.....Performance Requirements for Hose Connection Vacuum Breakers
1013-2011.....Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers

1015-2011.....Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies

1017-2009.....Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems

1020-2004.....Performance Requirements for Pressure Vacuum Breaker Assembly

1035-2008.....Performance Requirements for Laboratory Faucet Backflow Preventers

1069-2005.....Performance Requirements for Automatic Temperature Control Mixing Valves

1070-2015.....Performance Requirements for Water Temperature Limiting Devices

1071-2012.....Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment

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

A126-2004(R2019).....Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

A276/A276M-2017.....Standard Specification for Stainless Steel Bars and Shapes

A536-1984(R2019e).....Standard Specification for Ductile Iron Castings

B62-2017.....Standard Specification for Composition Bronze or Ounce Metal Castings

B584-2014.....Standard Specification for Copper Alloy Sand Castings for General Applications

E. International Code Council (ICC):

IPC-2018.....International Plumbing Code

F. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

SP-25-2018.....Standard Marking Systems for Valves, Fittings, Flanges and Unions

SP-70-2011.....Gray Iron Gate Valves, Flanged and Threaded Ends

SP-71-2018.....Gray Iron Swing Check Valves, Flanged and Threaded Ends

SP-80-2019.....Bronze Gate, Globe, Angle, and Check Valves

SP-85-2011.....Gray Iron Globe & Angle Valves, Flanged and Threaded Ends

SP-110-2010.....Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

G. National Environmental Balancing Bureau (NEBB):

8th Edition 2015 Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems

H. NSF International (NSF):

61-2019.....Drinking Water System Components – Health Effects

372-2016.....Drinking Water System Components – Lead Content

I. University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USC FCCCHR):

10th Edition.....Manual of Cross-Connection Control

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Ball Valves.
2. Gate Valves.
3. Check Valves.

D. Test and Balance reports for balancing valves.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts and troubleshooting guide:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
4. Piping diagrams of thermostatic mixing valves to be installed.

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. 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.

1.6 AS BUILT DOCUMENTATION

A. Comply with requirements in Paragraph “AS-BUILT DOCUMENTATION” of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

2.1 VALVES, GENERAL

A. Asbestos packing and gaskets are prohibited.

B. All valves shall be stainless steel.

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. Bio-Based Materials: For products designated by the USDA’s bio-based Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all

performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

E. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

2.2 SHUT-OFF VALVES

A. Hot and Re-circulating Hot Water:

1. 50 mm or DN50 (2 inches) and smaller: Ball, MSS 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 4138 kPa (600 psig). The body material shall be stainless steel ASTM B584. The ends shall be non-lead solder.

2.3 CHECK VALVES

A. 75 mm or DN75 (3 inches) and smaller shall be Class 125, stainless swing check valves with non-metallic disc suitable for type of service. The check valve shall meet ASTM 316 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 stainless steel material conforming to ASTM 316, solder joints, and PTFE or TFE disc.

2.4 GLOBE VALVES

A. 75 mm or DN75 (3 inches) or smaller: Class 150, stainless steel globe valve with non-metallic disc. The globe valve shall meet ASTM 316 stainless steel 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 B62 with solder ends, SS316 stem, PTFE or TFE disc, and malleable iron hand wheel.

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 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. Check valves shall be installed for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level and on top of valve.

F. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that shall be sources of contamination. Comply with authorities having jurisdiction. Locate backflow preventers in same room as connected equipment or system.

1. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are prohibited for this application.

G. Install pressure gauges on outlet of backflow preventers.

H. Do not install bypass piping around backflow preventers.

I. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets.
   1. Install thermometers if specified.
   2. Install cabinet-type units recessed in or surface mounted on wall as specified.

J. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

K. Install thermostatic balancing valves with inlet strainer and inlet and outlet isolation valves.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Calibrated balancing valves.
   2. Master, thermostatic, water mixing valves.
   3. Manifold, thermostatic, water-mixing-valve assemblies.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

3.4 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. Valves shall be replaced if persistent leaking occurs.

B. Set field-adjustable flow set points of balancing valves and record data. Ensure recorded data represents actual measured or observed conditions. Permanently mark settings of valves and other adjustment devices allowing settings to be restored. Set and lock memory stops. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

D. Testing and adjusting of balancing valves shall be performed by an independent NEBB Accredited Test and Balance Contractor. A final settings and flow report shall be submitted to the VA Contracting Officer’s Representative (COR).

3.5 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

3.6 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

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09-01-19

SECTION 22 07 11
PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Field applied insulation for thermal efficiency and condensation control for the following:
   1. Plumbing piping and equipment.
   2. Re-insulation of plumbing piping and equipment after asbestos abatement and or replacement of any part of existing insulation system (insulation, vapor retarder jacket, protective coverings/jacket) damaged during construction.

B. Definitions:
   1. ASJ: All Service Jacket, Kraft paper, white finish facing or jacket.
   2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
   3. All insulation systems installed within supply, return, exhaust, relief and ventilation air plenums shall be limited to uninhabited crawl spaces, areas above a ceiling or below the floor, attic spaces, interiors of air conditioned or heating ducts, and mechanical equipment rooms shall be noncombustible or shall be listed and labeled as having a flame spread indexes of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723. Note: ICC IMC, Section 602.2.1.
   4. Cold: Equipment or piping handling media at design temperature of 15 degrees C (60 degrees F) or below.
   5. Concealed: Piping above ceilings and in chases.
   6. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms or exposed to outdoor weather. Shafts, chases, are not considered finished areas.
   7. FSK: Foil-scrim-Kraft facing.
   8. Hot: Plumbing equipment or piping handling media above 40 degrees C (104 degrees F).
   9. Density: kg/m^3 - kilograms per cubic meter (Pcf - pounds per cubic foot).

10. Thermal conductance: Heat flow rate through materials.
    a. Flat surface: Watts per square meter (BTU per hour per square foot).
    b. Pipe or Cylinder: Watts per linear meter (BTU per hour per linear foot) for a given outside diameter.
11. Thermal Conductivity (k): Watts per meter, per degree K (BTU - 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/vapor barriers shall have a maximum published permeance of .02 perms.
13. HWR: Hot water recirculating.
14. CW: Cold water.
15. SW: Soft water.
16. HW: Hot water.
17. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Insulation material and insulation production method.

G. Section 07 84 00, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.

I. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: General mechanical requirements and items, which are common to more than one section of Division 22.

K. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING: Hot and cold water piping.

M. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

N. Section 23 21 13, HYDRONIC PIPING: electrical heat tracing systems.

09-01-19

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

B209-2014.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C411-2011.....Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

C449-2007 (R2013).....Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

C450-2008 (R2014).....Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging

Adjunct to C450.....Compilation of Tables that Provide Recommended Dimensions for Prefab and Field Thermal Insulating Covers, etc.

C533-2013.....Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

C534/C534M-2014.....Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C547-2015.....Standard Specification for Mineral Fiber Pipe Insulation

C552-2014.....Standard Specification for Cellular Glass Thermal Insulation

C553-2013.....Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

C591-2013.....Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

C680-2014.....Standard Practice for Estimate of the Heat Gain or Loss and the Surface Temperatures of

Insulated Flat, Cylindrical, and Spherical Systems by Use of Computer Programs

C612-2014.....Standard Specification for Mineral Fiber Block and Board Thermal Insulation

C1126-2014.....Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation

C1136-2012.....Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

C1710-2011.....Standard Guide for Installation of Flexible Closed Cell Preformed Insulation in Tube and Sheet Form

D1668/D1668M-1997a (2014)e1 Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing

E84-2015a.....Standard Test Method for Surface Burning Characteristics of Building Materials

E2231-2015.....Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation to Assess Surface Burning Characteristics

C. Federal Specifications (Fed. Spec.):

L-P-535E-1979.....Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.

D. International Code Council, (ICC):

IMC-2012.....International Mechanical Code

E. Military Specifications (Mil. Spec.):

MIL-A-3316C (2)-1990....Adhesives, Fire-Resistant, Thermal Insulation

MIL-A-24179A (2)-1987...Adhesive, Flexible Unicellular-Plastic Thermal Insulation

MIL-PRF-19565C (1)-1988.Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier

MIL-C-20079H-1987.....Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass

F. National Fire Protection Association (NFPA):
   90A-2015.....Standard for the Installation of Air-Conditioning and Ventilating Systems
G. Underwriters Laboratories, Inc (UL):
   723-2008 (R2013).....Standard for Test for Surface Burning Characteristics of Building Materials
   1887-2004 (R2013).....Standard for Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics
H. 3E Plus® version 4.1 Insulation Thickness Computer Program: Available from NAIMA with free download; https://insulationinstitute.org/tools-resources/

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 07 11, PLUMBING INSULATION”, with applicable paragraph identification.
C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
D. Shop Drawings:
   1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM Designation, Federal and Military specifications.
      a. Insulation materials: Specify each type used and state surface burning characteristics.
      b. Insulation facings and jackets: Each type used and state surface burning characteristics.
      c. Insulation accessory materials: Each type used.
      d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation shall follow the guidelines in accordance with ASTM C1710.

e. Make reference to applicable specification paragraph numbers for coordination.

f. All insulation fittings (exception flexible unicellular insulation) shall be fabricated in accordance with ASTM C450 and the referenced Adjunct to ASTM C450.

1.5 QUALITY ASSURANCE

A. Refer to article QUALITY ASSURANCE, in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

B. Criteria:

1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.11.2.6, parts of which are quoted as follows:

4.3.3.1 Pipe and duct insulation and 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 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 ASTM E84 and appropriate mounting practice, e.g. ASTM E2231.

4.3.3.3 Coverings and linings for air ducts, pipes, plenums and panels including all pipe and duct insulation materials shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service. In no case shall the test temperature be below 121 degrees C (250 degrees F).

4.3.11.2.6.3 Nonferrous fire sprinkler piping 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 1887, Standard for Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.

4.3.11.2.6.8 Smoke detectors shall not be required to meet the provisions of Section 4.3.

2. Test methods: ASTM E84, UL 723, and ASTM E2231.

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.

D. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CAD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

D. Certification documentation shall be provided prior to submitting the request for final inspection. The documentation shall include all test

results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

1.7 STORAGE AND HANDLING OF MATERIAL

A. Store materials in clean and dry environment, pipe insulation 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.

PART 2 - PRODUCTS

2.1 MINERAL FIBER OR FIBER GLASS

A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m^3 (nominal 3 pcf), k = 0.037 (.26) at 24 degrees C (75 degrees F).

B. ASTM C553 (Blanket, Flexible) Type I, Class B-3, Density 16 kg/m^3 (nominal 1 pcf), k = 0.045 (0.31) Class B-5, for use at temperatures up to 204 degrees C (400 degrees F).

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 (446 degrees F) with an all service vapor retarder jacket (ASJ) and with polyvinyl chloride (PVC) premolded fitting covering.

2.8 INSULATION FACINGS AND JACKETS

A. Vapor Retarder, higher strength with low water permeance = 0.02 or less perm rating, Beach puncture 50 units for insulation facing on pipe insulation jackets. Facings and jackets shall be ASJ or PVDC Vapor Retarder jacketing.

B. ASJ shall be white finish (kraft paper) bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture is 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: FSK or PVDC type for concealed ductwork and equipment.

D. Except for flexible elastomeric cellular thermal insulation (not for high humidity exposures), field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping as well as on interior piping 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. Except for cellular glass thermal insulation, when all longitudinal and circumferential joints are vapor sealed with a vapor barrier mastic or caulking, vapor barrier jackets may not be provided. For aesthetic and physical abuse applications, exterior jacketing is recommended. Otherwise field applied vapor barrier jackets shall be provided, in addition to the applicable specified facings and jackets, on all exterior piping as well as on interior piping. 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.

G. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be PVC conforming to Fed Spec L-P-535E, 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. Staples, tacks, or any other attachment that penetrates the PVC covering is not allowed on any form of a vapor barrier system in below ambient process temperature applications.

2.9 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/m³ (3.0 pcf).

Nominal Pipe Size and Accessories Material (Insert Blocks)	
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/m³ (3.0 pcf).

2.10 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-24179A, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.

D. Mil. Spec. MIL-PRF-19565C, Type I: Protective finish for outdoor use.

E. Mil. Spec. MIL-PRFC-19565C, 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.

2.11 MECHANICAL FASTENERS

A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.

B. Staples: Outward clinching galvanized steel. Staples are not allowed for below ambient vapor barrier applications.

C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy or stainless steel.

D. Bands: 13 mm (1/2 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

E. Tacks, rivets, screws or any other attachment device capable of penetrating the vapor retarder shall NOT be used to attach/close the any type of vapor retarder jacketing. Thumb tacks sometimes used on PVC jacketing and preformed fitting covers closures are not allowed for below ambient vapor barrier applications.

2.12 REINFORCEMENT AND FINISHES

A. Glass fabric, open weave: ASTM D1668/D1668M, Type III (resin treated) and Type I (asphalt or white resin treated).

B. Glass fiber fitting tape: Mil. Spec MIL-C-20079H, 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-535E, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 10 to 121 degrees C (50 to 250 degrees F). Below 10 degrees C (50 degrees F) and above 121 degrees C (250 degrees F) provide mitered pipe insulation of the same type as insulating straight pipe. Provide double layer insert. Provide vapor barrier pressure sensitive tape matching the color of the PVC jacket.

2.13 FIRESTOPPING MATERIAL

A. Other than pipe insulation, refer to Section 07 84 00, FIRESTOPPING.

2.14 FLAME AND SMOKE

A. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM and UL standards and specifications. See paragraph "Quality Assurance".

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Required pressure tests of piping joints and connections shall be completed and the work approved by the Contracting Officer’s Representative (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 or as noted, insulate all specified equipment, and piping (pipe, fittings, valves, accessories). Insulate each pipe individually. Do not use scrap pieces of insulation where a full length section will fit.

D. Insulation materials shall be installed with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down and sealed at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A).

E. Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 15 degrees C (60 degrees F) and below. Lap and seal vapor barrier 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).

F. Install vapor stops with operating temperature 15 degrees C (60 degrees F) and below at all insulation terminations on either side of valves, pumps, fittings, and equipment and particularly in straight lengths every 4.6 to 6.1 meters (approx. 15 to 20 feet) of pipe insulation. The annular space between the pipe and pipe insulation of approx. 25 mm (1 inch) in length at every vapor stop shall be sealed with appropriate vapor barrier sealant. Bio-based materials shall be utilized when possible.

G. Construct insulation on parts of equipment such as cold water pumps 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. Do not insulate over equipment nameplate data.

H. 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 coating (caution about coating’s maximum temperature limit) or jacket material.

I. 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.

J. Plumbing work not to be insulated unless otherwise noted:
   1. Piping and valves of fire protection system.
   2. Chromium plated brass piping.
   3. Water piping in contact with earth.
   4. Distilled water piping.

K. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum wet or dry film thickness. Bio-based materials shall be utilized when possible.

L. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. Use of polyurethane or polyisocyanurate spray-foam to fill a PVC elbow jacket is prohibited on cold applications.

M. Firestop Pipe insulation:
   1. Provide firestopping insulation at fire and smoke barriers through penetrations. Firestopping insulation shall be UL listed as defined in Section 07 84 00, FIRESTOPPING.
   2. Pipe penetrations requiring fire stop insulation including, but not limited to the following:
      a. Pipe risers through floors
      b. Pipe chase walls and floors
      c. Smoke partitions
      d. Fire partitions
      e. Hourly rated walls

N. Freeze protection of above grade outdoor piping (over heat tracing tape): 20 mm (3/4 inch) thick insulation, for all pipe sizes 75 mm (3 inches) and smaller and 25 mm (1 inch) thick insulation for larger pipes. Provide metal jackets for all pipe insulations. Provide freeze

protection for cold water make-up piping and equipment where indicated on the drawings as described in Section 23 21 13, HYDRONIC PIPING (electrical heat tracing systems).

O. Provide vapor barrier systems as follows:
   1. All piping exposed to outdoor weather.

P. Provide metal jackets over insulation as follows:
   1. All plumbing piping exposed to outdoor weather.
   2. Piping exposed in building, within 1829 mm (6 feet) of the floor, that connects to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets except for cold pipe or tubing applications. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.
   3. A 50 mm (2 inch) jacket overlap is required at longitudinal and circumferential joints with the overlap at the bottom.

Q. Provide PVC jackets over insulation as follows:
   1. Piping exposed in building, within 1829 mm (6 feet) of the floor, on piping that is not precluded in previous sections.
   2. A 50 mm (2 inch) jacket overlap is required at longitudinal and circumferential joints with the overlap at the bottom.

3.2 INSULATION INSTALLATION

B. Molded Mineral Fiber Pipe and Tubing Covering:
   1. Fit insulation to pipe, aligning all 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 except for cold piping. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide cellar glass 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 15 degrees C (60 degrees F) or more.
      b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts surface temperature of above 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Provide mitered preformed

insulation of the same type as the installed straight pipe insulation for pipe temperatures below 4 degrees C (40 degrees F). Secure first layer of mineral fiber insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.

c. Factory preformed, ASTM C547 or fabricated mitered sections, joined with adhesive or (hot only) wired in place. (Bio-based materials shall be utilized when possible.) For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 15 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.

C. Rigid Cellular Phenolic Foam:

1. Rigid closed cell phenolic insulation may be provided, exterior only, for piping, ductwork and equipment for temperatures up to 121 degrees C (250 degrees F).
2. Note the ASTM E84 or UL 723 surface burning characteristics requirements of maximum 25/50 indexes in paragraph "Quality Assurance".
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. Condensation control insulation: Minimum 25 mm (1 inch) thick for all pipe sizes depending on high humidity exposures.

a. Body of roof and overflow drains horizontal runs and offsets (including elbows) of interior downspout piping in all areas above pipe basement.

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b. Waste piping from electric water coolers and icemakers to drainage system.
c. Waste piping located above basement floor from ice making and film developing equipment and air handling units, from equipment (including trap) to main vertical waste pipe.
d. MRI quench vent piping.
e. Bedpan sanitizer atmospheric vent
f. Reagent grade water piping.

g. Cold water piping, exterior only.

- - - E N D - - -

SECTION 22 14 00
FACILITY STORM DRAINAGE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the requirements for storm drainage systems, including piping and all necessary accessories as designated in this section.

B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

E. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures.

F. Section 07 92 00, JOINT SEALANTS.

G. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.

I. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: Pipe Hangers and Supports, Materials Identification.

K. Section 22 07 11, PLUMBING INSULATION.

1.3 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):

A112.6.4-2003 (R2012) ..Roof, Deck, and Balcony Drains
A13.1-2007 (R2013).....Scheme for Identification of Piping Systems
B1.20.1-2013.....Pipe Threads, General Purpose, Inch
B16.3-2011.....Malleable Iron Threaded Fittings: Classes 150 and 300
B16.9-2012.....Factory-Made Wrought Buttwelding Fittings
B16.11-2011.....Forged Fittings, Socket-Welding and Threaded
B16.12-2009 (R2014).....Cast Iron Threaded Drainage Fittings
B16.15-2013.....Cast Copper Alloy Threaded Fittings: Classes 125 and 250
B16.18-2012.....Cast Copper Alloy Solder-Joint Pressure Fittings

B16.22-2013.....Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

B16.23-2011.....Cast Copper Alloy Solder Joint Drainage Fittings - DWV

B16.29-2012.....Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings – DWV

C. American Society of Sanitary Engineering (ASSE)

1079-2012.....Performance Requirements for Dielectric Pipe Unions

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

A47/A47M-1999 (R2014)...Standard Specification for Ferritic Malleable Iron Castings

A53/A53M-2012.....Standard Specification for Pipe, Steel, Black And Hot-Dipped, Zinc-coated Welded and Seamless

A74-2013a.....Standard Specification for Cast Iron Soil Pipe and Fittings

A183-2014.....Standard Specification for Carbon Steel Track Bolts and Nuts

A312/A312M-2015.....Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

A536-1984(R2014).....Standard Specification for Ductile Iron Castings

A733-2013.....Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples

A888-2013a.....Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

B32-2008 (R2014).....Standard Specification for Solder Metal

B61-2008 (R2013).....Standard Specification for Steam or Valve Bronze Castings

B62-2009.....Standard Specification for Composition Bronze or Ounce Metal Castings

B75/B75M-2011.....Standard Specification for Seamless Copper Tube

B88-2014.....Standard Specification for Seamless Copper Water Tube

B306-2013.....Standard Specification for Copper Drainage Tube (DWV)

B584-2014.....Standard Specification for Copper Alloy Sand Castings for General Applications

B687-1999 (R2011).....Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples

B828-2002 (R2010).....Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings

B813-2010.....Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube

C564-2014.....Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

C1173-2010 (R2014).....Standard Specification for Flexible Transition Couplings for Underground Piping Systems

D1785-2012.....Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120

D2000-2012.....Standard Classification System for Rubber Products in Automotive Applications

D2321-2014e1.....Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2564-2012.....Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems

D2665-2014.....Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

D2855-1996 (R2010).....Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

D4101-2014.....Standard Specification for Polypropylene Injection and Extrusion Materials

D5926-2011.....Standard for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems

F477-2014.....Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F656-2010.....Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

F1545-2015.....Standard Specification for Plastic-Lined Ferrous Metal Pipe, Fittings, and Flanges

E. American Welding Society (AWS):

A5.8M/A5.8 AMD1-2011....Specification for Filler Metals for Brazing and Braze Welding

F. Copper Development Association (CDA):

A4015-2011.....Copper Tube Handbook

G. Cast Iron Soil Pipe Institute (CISPI):

301-2012.....Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

310-2012.....Standard Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

H. International Code Council (ICC):

IPC-2012.....International Plumbing Code

I. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

SP-72-2010a.....Ball Valves with Flanged or Butt-Welding Ends for General Service

SP-110-2010.....Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 14 00, FACILITY STORM DRAINAGE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Pipe and Fittings.
   2. Specialty Pipe Fittings.
   3. Cleanouts.
   4. Roof Drains.
   5. Expansion Joints.
   6. Downspout Nozzles.
   7. Sleeve Flashing Devices.
D. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 AS-BUILT DOCUMENTATION

A. Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.
B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CAD version. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the ‘third party testing company’ requirement.

D. Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

PART 2 - PRODUCTS

2.1 STORM WATER DRAIN PIPING

C. Polyvinyl Chloride (PVC):

1. PVC storm sewer pipe and fittings are permitted for single story structures except for mechanical equipment rooms and other areas containing air handling equipment or hot water generation equipment.
2. PVC storm sewer pipe and fittings shall be schedule 40 solid core piping conforming to ASTM D1785 and ASTM D2665, Sewer and Drain Series, with ends for solvent cemented joints.
3. PVC joints shall be solvent welded socket type using solvent cement conforming to ASTM D2564 and adhesive primer conforming to ASTM F656. Bio-based materials shall be utilized when possible.

D. Roof drain piping and body of drain in locations where the outdoor conditions are subject to freezing shall be insulated.

2.2 PUMPED DRAIN PIPING

A. Pumped drain piping 75 mm (3 inches) and less shall be copper tube conforming to ASTM B88, type K or L. For pumped drain piping 100 mm (4 inches) and greater, galvanized steel conforming to ASTM A53/A53M, seamless, schedule 40 may be used.

B. Pumped drain pipe fittings shall comply with the following:

1. Wrought copper or bronze castings for use with copper tube conforming to ASME B16.18 and B16.22.

2. Unions, for use with copper tube up to 50 mm (2 inches) shall be cast with bronze, conforming to ASME B16.18 and ASTM B584 with solder or braze joints.
3. Grooved fittings, for use with copper tube 65 mm to 100 mm (2-1/2 to 4 inch) shall be wrought copper conforming to ASTM B75/B75M, alloy C12200, 125 to 150 mm (5 to 6 inch) bronze castings conforming to ASTM B584.
4. Mechanical grooved couplings shall have a ductile iron housing conforming to ASTM A536 (Grade 65-45-12) elastomer gasket suitable for potable water service and process temperature and steel track head bolts conforming to ASTM A183, housing shall be coated with colored alkyd enamel paint.

C. Adapters shall be provided for joining pipe with different end connections.

D. The solder shall be lead free using a water flushable, non-corrosive flux conforming to ASTM B32.

E. Dielectric fittings and specialties shall be provided when joining pipe of dissimilar metals.

2.3 SPECIALTY PIPE FITTINGS

A. Transition pipe couplings shall join piping with small differences in outside diameters or be of different materials. End connections shall be of the same size and compatible with the pipes being joined. The transition coupling shall be unshielded, elastomeric, sleeve type reducing or transition pattern conforming with ASTM C1173 and include shear ring and corrosion resistant metal tension band and tightening mechanism on each end. The transition coupling sleeve coupling shall be of the following material:

1. For cast iron soil pipes, the sleeve material shall be rubber conforming to ASTM C564.
2. For PVC soil pipes, the sleeve material shall be elastomeric seal conforming to ASTM F477 or PVC conforming to ASTM D5926.
3. dissimilar pipes, the sleeve material shall be PVC conforming to ASTM D5926, or other material compatible with the pipe materials being joined.

B. Dielectric fittings shall conform to ASSE 1079 with a pressure rating of 1725 kPa (250 psig) at a minimum temperature of 82 degrees C (180

degrees F). The end connection shall be solder joint copper alloy and threaded ferrous.

C. Dielectric flanges shall conform to ASSE 1079 with a pressure rating of 1035 kPa (150 psig) The flange shall be a factory fabricated, bolted, companion flange assembly. The end connection shall be threaded or solder-joint copper alloy and threaded ferrous.

D. Dielectric flange insulating kits shall be of non-conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.

E. Dielectric nipples shall be electroplated steel and shall conform with ASTM F1545 with a pressure ratings of 2070 kPa (300 psig) at 107 degrees C (225 degrees F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene. Bio-based materials shall be utilized when possible.

2.6 WATERPROOFING

A. A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab. A waterproofed caulked joint shall be provided at the top hub.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. The pipe installation shall comply with the requirements of the IPC and these specifications.

B. Branch piping shall be installed from the piping system and connect to all drains and outlets.

C. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for glass, shall be reamed to remove burrs and a clean smooth finish restored to full pipe inside diameter.

D. All pipe runs shall be laid out to avoid interference with other work/trades.

E. The piping shall be installed above accessible ceilings to allow for ceiling panel removal.

F. Unless otherwise stated on the documents, minimum horizontal slope shall be one inch for every 2.44 m (8 feet) (1 percent slope) of pipe length.

G. The piping shall be installed free of sags and bends.

H. Seismic restraint shall be installed where required by code.

I. Changes in direction for storm drainage piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep ¼ bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and 1/8 bend fittings shall be used if two drains are installed back to back or side by side with common drain pipe. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Buried storm drainage piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer’s written instruction for use of lubricants, cements, and other installation requirements. Bio-based materials shall be utilized when possible.

K. Cast iron piping shall be installed according to CISPI’s “Cast Iron Soil Pipe and Fittings Handbook,” Chapter IV, “Installation of Cast Iron Soil Pipe and Fittings”

L. Aboveground copper tubing shall be installed according to CDA A4015.

M. Aboveground PVC piping shall be installed according to ASTM D2665. Underground PVC piping shall be installed according to ASTM D2321.

3.2 JOINT CONSTRUCTION

A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI’s “Cast Iron Soil Pipe and Fittings Handbook” for compression joints.

B. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

C. Hubless, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.

D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service
2. Pipe sections with damaged threads shall be replaced with new undamaged sections of pipe at no additional time or cost to Government.

E. Copper tube and fittings with soldered joints shall be joined according to ASTM B828. A water flushable, lead free flux conforming to ASTM B813 and a lead free alloy solder conforming to ASTM B32 shall be used.

F. For PVC piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2855 and ASTM D2665 appendices.

3.3 SPECIALTY PIPE FITTINGS

A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.

B. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

3.4 PIPE HANGERS, SUPPORTS AND ACCESSORIES

A. All piping shall be supported according to the IPC, Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications.

B. Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.

D. PVC piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:
   1. NPS 1-1/2 to NPS 2 (DN 40 to DN 50): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
E. The maximum support spacing for horizontal plastic shall be 1.22 m (4 feet).
F. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.6 m (15 feet).
G. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, floor, wall and ceiling plates shall have the following characteristics:
   1. Solid or split unplated cast iron.
   2. All plates shall be provided with set screws.
   3. Height adjustable clevis type pipe hangers.
   4. Adjustable Floor Rests and Base Flanges shall be steel.
   5. Hanger Rods shall be low carbon steel, fully threaded or threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
   6. Riser Clamps shall be malleable iron or steel.
   7. Roller shall be cast iron.
   8. Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (minimum) metal protection shield centered on and welded to the hanger and support. The shield shall be 100 mm (4 inches) in length and be 1.6 mm (16 gage) steel. The shield shall be sized for the insulation.
H. Miscellaneous materials shall be provided as specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6.1 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. All necessary auxiliary steel shall be provided to provide that support.
I. Cast escutcheon with set screw shall be installed at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
J. Penetrations:
   1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that

provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.

2. Water proofing: At floor penetrations, Clearances around the pipe shall be completely sealed and made watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials shall be utilized when possible.

3.5 INSULATION

A. Insulate horizontal sections and 600 mm (2 feet) past changes of direction to vertical sections for interior section of roof drains. Install insulation in accordance with the requirements of Section 22 07 11, PLUMBING INSULATION.

3.6 TESTS

A. Storm sewer system shall be tested either in its entirety or in sections.

B. Storm Water Drain tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.

1. If entire system is tested with water, tightly close all openings in pipes except the highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.

2. For an air test, an air pressure of 34 kPa (5 psig) gage shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the test.

3. Final Tests: While either one of the following tests may be used, Contractor shall check with VA as to which test will be performed.

a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with

smoke under pressure of 0.25 kPa (1 inch of water) with a smoke machine. **Chemical smoke is prohibited.**

b. Peppermint Test: Introduce .06 liters (2 ounces) of peppermint into each line or stack.

C. COR shall witness all tests. Contractor shall coordinate schedules with the COR and CxA. Contractor shall provide a minimum of 10 working days prior to flushing, disinfection/sterilization, startup, and testing.

3.8 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for four hours to instruct VA Personnel in operation and maintenance of the system.

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SUSECTION 22 14 29
SUMP PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Sump pumps. See schedule on Drawings for pump capacity and head.

B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

F. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

G. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.

H. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING

J. Section 26 29 11, MOTOR CONTROLLERS.

1.3 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 National Standard Institute (ANSI)/Hydraulic Institute (HI):

1.1-1.2-2014.....Rotodynamic Centrifugal Pumps for Nomenclature and Definitions

1.3-2013.....Rotodynamic Centrifugal Pumps for Design and Application

1.4-2014.....Rotodynamic Centrifugal Pumps for Manuals Describing Installation, Operation, and Maintenance

C. ASTM International (ASTM):

A48/A48M-2003 (R2012)...Standard Specification for Gray Iron Castings

A532/A532M-2010 (R2014).Standard Specification for Abrasion-Resistant Cast Irons

B584-2014.....Standard Specification for Copper Alloy Sand Castings for General Applications

D. National Electrical Manufacturers Association (NEMA):

ICS 6-1993 (R2001, R2006) Industrial Control and Systems: Enclosures

250-2014.....Enclosures for Electrical Equipment (1000 Volts Maximum)

E. Underwriters' Laboratories, Inc. (UL):

508-1999 (R2013).....Standards for Industrial Control Equipment

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 14 29, SUMP PUMPS”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Pump:
   a. Manufacturer and model.
   b. Operating speed (rpm).
   c. Capacity.
   d. Characteristic performance curves.
2. Electric Motor:
   a. Manufacturer,
   b. Speed.
   c. Current Characteristics and W (HP).
   d. Efficiency.
3. Control panel.
4. Sensors.

D. Certified copies of all the factory and construction site test data sheets and reports.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replacement parts:

1. Include complete list which indicates all components of the system.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance, and troubleshooting.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CADD version. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

D. Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and a certification that all results of tests were within limits specified.

PART 2 - PRODUCTS

2.1 SUMP PUMP

A. Centrifugal, vertical, surface mounted pump and motor, designed 180 degrees F) maximum water service. Driver shall be electric motor. Support shall be rigid type. Provide perforated, suction strainer. Systems may include one, two, or more pumps with alternator as required by Contract Documents. Pumps shall be capable of continuous duty cycle.

B. Impeller: Statically and dynamically balanced, keyed and secured to shaft, cast iron ASTM A532/A532M .

C. Shaft: Stainless steel or other approved corrosion-resisting metal.

D. Bearings: As required to hold shaft alignment, anti-friction type for thrust permanently lubricated. Bio-based materials shall be utilized when possible.

E. Seal: Mechanical.

F. Motor: Maximum 40 degrees C (104 degrees F) ambient temperature rise above the maximum fluid temperature being pumped , drip-proof hermitically sealed, lifting eye, capacitor start type, voltage and phase as shown in schedule on Electrical drawings conforming to NEMA Type 4X . Size the motor capacity to operate pump without overloading the motor at any point on the pump curve. Refer to Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.

G. Starting Switch: Manually-operated, tumbler type, as specified in Section 26 29 11, MOTOR CONTROLLERS.

H. Automatic Control and Level Alarm: The controls shall be suitable for operation with the electrical characteristics listed on the Electrical drawings. The control panel shall have a level control system with switches to start and stop pumps automatically, and to activate a high water alarm. The level control system shall include sensors in the sump that detect the level of the liquid. The sensors may be float type switches, ultrasonic level sensors, or transducers. The high water alarm shall have a red beacon light at the control panel and a buzzer, horn, or bell. The alarm shall have a silencing switch. Provide auxiliary contacts for remote communication with, and alarm monitoring to, the BAS using a JCI Simplex interface to DDC Controls System.

   1. The circuitry of the control panel shall include:

      a. Power switch to turn on/off the automatic control mechanism

      b. HOA switches to manually override automatic control mechanism

c. Run lights to indicate when pumps are powered up
d. Level status lights to indicate when water in sump has reached the predetermined on/off and alarm levels
e. Magnetic motor contactors
f. Disconnect/breaker for each pump
g. Automatic motor overload protection
h. Wiring terminal block
i. Dead front
j. Auxiliary contacts
k. Control circuit protection

2. Sensors that detect the level of water in the sump shall be so arranged as to allow the accumulation of enough volume of liquid below the normal on-level that the pump will run for a minimum cycle time as recommended by the pump manufacturer. Sensors shall be located to activate the alarm adequately before the water level rises to the inlet pipe.
3. Provide two separate power supplies to the control panel, one for the control/alarm circuitry and one for power to the pump motors. Each power supply is to be fed from its own breaker so that if a pump overload trips a breaker, the alarm system shall still function. Each power supply is to be wired in its own conduit.
4. Wiring from the sump to the control panel shall have separate conduits for the pump power and for the sensor switches. All conduits are to be sealed and at the control panel to prevent the intrusion of moisture and of flammable and/or corrosive gases.

J. Provide a check and ball valve in the discharge of each pump. Refer to Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING.

PART 3 - EXECUTION

3.1 STARTUP AND TESTING

A. Pump installation to comply with ANSI/HI 1.4 for sump pumps.
B. Leak Test: Charge piping system and test for leaks. Test until there are no leaks. Make tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

C. The tests shall include system capacity and all control and alarm functions.

D. When any defects are detected, correct defects and repeat test.

E. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Contractor shall provide a minimum of 10 working days prior to startup and testing.

3.3 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for four/ hours to instruct VA Personnel in operation and maintenance of units.

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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, HEATING, VENTILATING, AND AIR CONDITIONING (HVAC).

B. Definitions:

1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
2. Exterior: Piping, ductwork, and equipment exposed to weather be it temperature, humidity, precipitation, wind, or solar radiation.

C. Abbreviations/Acronyms:

1. AC: Air Conditioning
2. ACU: Air Conditioning Unit
3. AI: Analog Input
4. BAS: Building Automation System
5. bhp: Brake Horsepower
6. Btu: British Thermal Unit
7. Btu/h: British Thermal Unit Per Hour
8. CFM: Cubic Foot Per Minute
9. CW: Cold Water
10. DVD: Digital Video Disc
11. DN: Diameter Nominal
12. DWV: Drainage, Waste and Vent
13. F: Fahrenheit
14. FG: Fiberglass
15. gpm: Gallons Per Minute
16. hp: Horsepower
17. HW: Hot Water
18. HWH: Hot Water Heating Supply
19. HWHR: Hot Water Heating Return
20. Hz: Hertz
21. ID: Inside Diameter
22. lb: Pound
23. lb/hr: Pounds Per Hour
24. MAX: Maximum

25. MBtu/h: 1000 Btu/h
26. MBtu: 1000 Btu
27. MED: Medical
28. MFG: Manufacturer
29. MW: Megawatt
30. OD: Outside Diameter
31. PSIA: Pounds Per Square Inch Absolute
32. psig: Pounds Per Square Inch Gauge
33. RH: Relative Humidity
34. RPM: Revolutions Per Minute
35. SCFM: Standard Cubic Feet Per Minute
36. SPEC: Specification
37. STD: Standard
38. TAB: Testing, Adjusting, and Balancing
39. TDH: Total Dynamic Head
40. THERM: 100,000 Btu
41. V: Volt
42. VAC: Vacuum
43. VA: Veterans Administration
44. VAC: Voltage in Alternating Current
45. VA CFM: VA Construction & Facilities Management
46. VA CFM CSS: VA Construction & Facilities Management, Consulting Support Service
47. VAMC: Veterans Administration Medical Center

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
C. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
D. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
E. Section 07 84 00, FIRESTOPPING.
F. Section 07 92 00, JOINT SEALANTS.
G. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT.
H. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
I. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

J. Section 23 07 11, HVAC INSULATION.

K. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

L. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

M. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

N. Section 26 29 11, MOTOR CONTROLLERS.

1.3 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. Where conflicts occur these specifications and the VHA standard will govern.

B. Air-Conditioning, Heating, and Refrigeration Institute (AHRI):
430-2020.....Performance Rating of Central Station Air-Handling Unit Supply Fans

C. Air Movement and Control Association (AMCA):
410-1996.....Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans

D. American Society of Mechanical Engineers (ASME):
B31.1-2020.....Power Piping
B31.9-2020.....Building Services Piping
ASME Boiler and Pressure Vessel Code:
BPVC Section IX-2021 Welding, Brazing, and Fusing Qualifications

E. American Society for Testing and Materials (ASTM):
A36/A36M-2019.....Standard Specification for Carbon Structural Steel
A575-1996(2020).....Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades

F. Association for Rubber Products Manufacturers (ARPM):
IP-20-2015.....Specifications for Drives Using Classical V-Belts and Sheaves
IP-21-2016.....Specifications for Drives Using Double-V (Hexagonal) Belts
IP-24-2016.....Specifications for Drives Using Synchronous Belts
IP-27-2015.....Specifications for Drives Using Curvilinear Toothed Synchronous Belts

G. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.(MSS):
SP-58-2018.....Pipe Hangers and Supports-Materials, Design, Manufacture, Selection, Application, and Installation
SP-127-2014a.....Bracing for Piping Systems: Seismic–Wind–Dynamic Design, Selection, and Application

H. Military Specifications (MIL):
MIL-P-21035B-2021.....Paint High Zinc Dust Content, Galvanizing Repair (Metric)

I. National Fire Protection Association (NFPA):
70-2020.....National Electrical Code (NEC)
101-2021.....Life Safety Code

J. Department of Veterans Affairs (VA):
PG-18-10-2020(R2021)....Physical Security and Resiliency Design Manual

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 05 11, COMMON WORK RESULTS FOR HVAC”, with applicable paragraph identification.

C. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements, and all equipment that requires regular maintenance, calibration, etc are accessable from the floor or permanent work platform. It is the Contractor’s responsibility to ensure all submittals meet the VA specifications and requirements and it is assumed by the VA that all submittals do meet the VA specifications unless the Contractor has requested a variance in writing and approved by COR prior to the submittal. If at any time during the project it is found that any item does not meet the VA specifications and there was no variance approval the Contractor shall correct at no additional cost or time to the Government even if a submittal was approved.

D. If equipment is submitted which differs in arrangement from that shown, provide documentation proving equivalent performance, design standards and drawings that show the rearrangement of all associated systems. Additionally, any impacts on ancillary equipment or services such as foundations, piping, and electrical shall be the Contractor’s responsibility to design, supply, and install at no additional cost or time to the Government. VA approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

E. Prior to submitting shop drawings for approval, Contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed contract documents, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

F. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together. Coordinate and properly integrate materials and equipment to provide a completely compatible and efficient installation.

G. Coordination/Shop Drawings:

1. Submit complete consolidated and coordinated shop drawings for all new systems, and for existing systems that are in the same areas.
2. The coordination/shop 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 coordination/shop drawings of all piping and duct systems. The drawings should include all lockout/tagout points for all energy/hazard sources for each piece of equipment. Coordinate lockout/tagout procedures and practices with local VA requirements.
3. Do not install equipment foundations, equipment or piping until coordination/shop 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.

H. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity. 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 complete stress analysis for variable spring and constant support hangers.
   6. Wall, floor, and ceiling plates.

I. Rigging Plan: Provide documentation of the capacity and weight of the rigging and equipment intended to be used. The plan shall include the path of travel of the load, the staging area and intended access, and qualifications of the operator and signal person.

J. HVAC Maintenance Data and Operating Instructions:
   1. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
      a. Include complete list indicating all components of the systems.
      b. Include complete diagrams of the internal wiring for each item of equipment.
      c. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.
   2. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply for equipment. Include in

the listing for belts: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

K. Provide copies of approved HVAC equipment submittals to the TAB Subcontractor.

1.5 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. Equipment Vibration Tolerance:

1. Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT. Equipment shall be factory-balanced to this tolerance and re-balanced onsite, as necessary.
2. After HVAC air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.

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. Refer to all other sections for quality assurance requirements for systems and equipment specified therein.

3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. The products and execution of work specified in Division 23 sections shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments shall be enforced, along with requirements of local utility companies. The most stringent requirements of these specifications, local codes, or utility company requirements shall always apply. Any conflicts shall be brought to the attention of the COR.
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be of the same manufacturer and model number, or if different models are required they shall be of the same manufacturer and identical to the greatest extent possible (i.e., same model series).
6. Assembled Units: Performance and warranty of all components that make up an assembled unit shall be the responsibility of the manufacturer of the completed assembly.
7. 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.
8. Use of asbestos products or equipment or materials containing asbestos is prohibited.

E. HVAC Equipment Service Providers: Service providers shall be authorized and trained by the manufacturers of the equipment supplied. These providers shall be capable of responding onsite and provide acceptable service to restore equipment operations within 4hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shutdown of equipment; or within 24hours in a non-emergency. Submit names, mail and e-mail addresses and phone numbers of service personnel and companies providing service under these conditions for (as applicable to the project): fans, air handling units, chillers, cooling towers, control systems, pumps, critical instrumentation, computer workstation and programming.

F. HVAC Mechanical Systems Welding: Before any welding is performed, Contractor shall submit a certificate certifying that welders comply with the following requirements:
   1. HVAC mechanical systems welding shall meet ASME BPVC Section IX. Provide proof of current certification.
   2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
   3. Certify that each welder and welding operator has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
   4. All welds shall be stamped according to the provisions of the AWS or ASME as required herein and by the associated code.

G. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the COR with submittals. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material and removal by the Contractor and no additional cost or time to the Government.

H. 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 documents to the COR for resolution. Provide written hard copies and computer files on CD or DVD of manufacturer’s installation instructions to the COR with submittals prior to commencing installation of any item. Installation of the item will not be allowed to proceed until the recommendations are received and approved by the VA. Failure to furnish these recommendations is a cause for rejection of the material.
   2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include, but are not limited to, all types of valves, filters and strainers, transmitters, control devices. Prior to

commencing installation work, refer conflicts between this requirement and contract documents to the COR for resolution. Failure of the Contractor to resolve, or point out any issues will result in the Contractor correcting at no additional cost or time to the Government.

3. Complete coordination/shop drawings shall be required in accordance with paragraph SUBMITTALS. Construction work shall not start on any system until the coordination/shop drawings have been approved by VA.
4. Workmanship/craftsmanship will be of the highest quality and standards. The VA reserves the right to reject any work based on poor quality of workmanship this work shall be removed and done again at no additional cost or time to the Government.

I. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with current telephone numbers and e-mail addresses.

J. Guaranty: Warranty of Construction, FAR Clause 52.246-21.

K. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specification section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

L. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

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 or theft.
2. Large equipment such as boilers, chillers, cooling towers, fans, and air handling units if shipped on open trailer trucks shall be covered with shrink on plastics or water proof tarpaulins that provide protection from exposure to rain, road salts and other

transit hazards. Protection shall be kept in place until equipment is moved into a building or installed as designed.

3. Repair damaged equipment in first class, new operating condition and appearance; or, replace same as determined and directed by the COR. Such repair or replacement shall be at no additional cost or time to the Government.
4. 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.
5. 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.
6. Protect plastic piping and tanks from ultraviolet light (sunlight).

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 AS-BUILT DOCUMENTATION

A. Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.

B. The installing Contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. Should the installing Contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the ‘third party testing company’ requirement. Provide record drawings as follows:

1. As-built drawings are to be provided, with a copy of them on AutoCAD version provided on CD or DVD. The CAD drawings shall use multiple line layers with a separate individual layer for each system.

C. The as-built drawings shall indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc. Coordinate lockout/tagout procedures and practices with local VA requirements.

D. Certification documentation shall be provided to COR 21 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results shall contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results shall include all readings, including but not limited to data on device (make, model and performance characteristics), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

1.8 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 VAMC.

B. Maintenance of Service: Schedule all work to permit continuous service as required by the VAMC.

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 VAMC. These non-critical periods are limited to between 8 pm and 5 am in the appropriate off-season (if applicable). Provide at least 10 working days advance notice to the COR. The request shall include a detailed plan on the proposed shutdown and the intended work to be done along with manpower levels. All equipment and materials shall be onsite and

verified with plan 5days prior to the shutdown or it will need to be rescheduled.

D. Phasing of Work: Comply with all requirements shown on contract documents. Contractor shall submit a complete detailed phasing plan/schedule with manpower levels prior to commencing work. The phasing plan shall be detailed enough to provide milestones in the process that can be verified.

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. Storm water or ground water leakage is prohibited. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all equipment being operated by VA. Maintain all egress routes and safety systems/devices.

F. Acceptance of Work for Government Operation: As new equipment, systems and facilities are made available for operation and these items are deemed 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. Performance and warranty of all components that make up an assembled unit shall be the responsibility of the manufacturer of the completed assembly.

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. Equipment and components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a nameplate 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, shall be the same make and model. Exceptions must be approved by the VA, but may be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

A. 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 V-BELT DRIVES

A. Type: ARPM 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: ARPM IP-20 and ARPM IP-21.

C. Minimum Horsepower Rating: Motor horsepower plus recommended ARPM service factor (not less than 20 percent) in addition to the ARPM 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 ARPM 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 ARPM 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 AHRI 430:
1. Provide adjustable-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 the design air flow branch, 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.

J. Final Drive Set: If adjustment is required beyond the capabilities of the factory drive set, the final drive set shall be provided as part of this contract at no additional cost or time to the Government.

2.4 SYNCHRONOUS BELT DRIVES

A. Type: ARPM synchronous belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.
B. Dimensions, Rating and Selection Standards: ARPM IP-24 and ARPM IP-27.
C. Minimum Horsepower Rating: Motor horsepower plus recommended ARPM service factor (not less than 20 percent) in addition to the ARPM 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 ARPM standard allowances for installation and take-up.
F. Drives may utilize a single belt of manufacturer’s standard width for the application.
G. Multiple Belts: Matched to ARPM 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.

I. Final Drive Set: The final fan speeds required to just meet the system CFM and pressure requirements, without throttling the design air flow branch, shall be determined by fan law calculation. If adjustment is required beyond the capabilities of the factory drive set, the final drive set shall be provided as part of this contract at no additional cost or time to the Government.

2.5 ELECTRIC MOTORS

A. All material and equipment furnished, and installation methods shall conform to the requirements of Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT; Section 26 29 11, MOTOR CONTROLLERS; and, Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide special energy efficient premium efficiency type motors as scheduled.

2.6 VARIABLE SPEED MOTOR CONTROLLERS

A. Refer to Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 26 29 11, MOTOR CONTROLLERS for specifications.

B. Coordinate variable speed motor controller communication protocol with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

C. Provide variable speed motor controllers with or without a bypass contactor as indicated in the contract documents.

D. The combination of controller and motor shall be provided by the manufacturer of the driven equipment, such as pumps and fans, and shall be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e., air handlers, fans, pumps, shall be product of a single manufacturer.

E. Motors shall be premium efficiency type and be approved by the motor controller manufacturer. The controller-motor combination shall be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor/fan sheaves shall be fixed pitch.

F. Controller shall not add any current or voltage transients to the input ac power distribution system, DDC controls, sensitive medical

equipment, etc., nor shall be affected from other devices on the ac power system.

2.7 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown in the contract documents, and shown in the maintenance manuals. Identification for piping is specified in Section 09 91 00, PAINTING.

B. Use symbols, nomenclature and equipment numbers specified, shown in the contract documents, and shown in the maintenance manuals. In addition, provide bar code identification nameplate for all equipment which will allow the equipment identification code to be scanned into the system for maintenance and inventory tracking. Identification for piping is specified in Section 09 91 00, PAINTING.

C. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 5 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.

D. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 5 mm (3/16 inch) high riveted or bolted to the equipment.

E. Control Items: Label all instrumentation, temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.

F. Valve Tags and Lists:

1. HVAC and Mechanical Rooms: Provide for all valves other than for equipment in Section 23 82 00, CONVECTION HEATING AND COOLING UNITS and Section 23 36 00, AIR TERMNAL 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 mm (1/4 inch) for service designation on 19-gauge 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 279 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.

G. Ceiling Grid Labels:

1. 50 mm (2 inch) long by 13 mm (1/2 inch) wide by 0.025 mm (1 mil) thick UV resistant metalized polyester label with red border color and black custom lettering on white background interior. Peel and stick adhesive backing. Label and adhesive manufactured specifically for use in equipment inventory tagging.
2. Custom print labels with above ceiling HVAC equipment numbers.

2.8 FIRESTOPPING

A. Section 07 84 00, 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 AND BOILER PLANT INSULATION, for firestop pipe and duct insulation.

2.9 HVAC PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. Vibration Isolators: Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

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 by 100 mm (2 by 4 inches) 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 279 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-58. 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 100 mm (4 inches) thick when approved by the COR for each job condition.
3. Power-Driven Fasteners: Permitted in existing concrete or masonry not less than 100 mm (4 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 shall be used for individual copper tubing up to 22 mm (7/8 inch) outside diameter.

F. Attachment to Wood Construction: Wood screws or lag bolts.

G. Hanger Rods: Hot-rolled steel, ASTM A36/A36M or ASTM 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.

H. Hangers Supporting Multiple Pipes (Trapeze Hangers): Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 by 41 mm (1-5/8 by 1-5/8 inches), 2.7 mm (12 gauge), designed to accept special spring held, hardened steel nuts. Trapeze hangers are prohibited for use for steam supply and condensate piping.
1. Allowable Hanger Load: Manufacturers rating less 91 kg (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 13 mm (1/2 inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.

I. Supports for Piping Systems:
1. Select hangers sized to encircle insulation on insulated piping. Refer to Section 23 07 11, HVAC 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.

2.10 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 (1 inch) above finished floor and provide sealant for watertight joint.
2. For Blocked Out Floor Openings: Provide 38 mm (1-1/2 inch) angle set in silicone adhesive around opening.
3. For Drilled Penetrations: Provide 38 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

C. Penetrations through beams or ribs are prohibited but may be installed in concrete beam flanges. Any deviation from these requirements shall 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 Section 07 92 00, JOINT SEALANTS.

2.11 DUCT PENETRATIONS

A. Provide curbs for roof mounted piping, ductwork and equipment. Curbs shall be 457 mm (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 section 07 84 00, FIRESTOPPING.

2.12 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 (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.13 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 75 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.

2.14 ASBESTOS

A. Materials containing asbestos are prohibited.

PART 3 - EXECUTION

3.1 GENERAL

A. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. The coordination/shop drawings shall be submitted for review. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Equipment coordination/shop drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review. 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 gauges 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 in the contract documents.

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 is prohibited, except as permitted by COR where working area space is limited.
   2. Locate holes to avoid interference with structural members such as slabs, columns, ribs, beams or reinforcing. 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. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but shall be provided.
G. Electrical Interconnection of Instrumentation or Controls: This generally not shown but shall be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Devices shall be located so they are easily accessible for testing, maintenance, calibration, etc. The COR has the final determination on what is accessible and what is not. Comply with NFPA 70.
H. 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.

I. Concrete and Grout: Use concrete and non-shrink grout 20 MPa (3000 psig) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

J. Install gauges, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gauges to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

K. Install steam piping expansion joints as per manufacturer’s recommendations.

L. Work in Existing Building:

1. Perform as specified in paragraphs OPERATIONS AND STORAGE AREAS, paragraph ALTERATIONS, and paragraph RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, paragraph OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.

M. Work in Animal Research Areas: Seal all pipe and duct penetrations with silicone sealant to prevent entrance of insects.

N. Switchgear/Electrical Equipment Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and data/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 not 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 feet) above the equipment or to ceiling structure, whichever is lower (NFPA 70).

O. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance or inspections, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost or time 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, but not limited to motors, fans, pumps, belt guards, transformers, high voltage lines, conduit and raceways, piping, hot surfaces, and ductwork. The COR has final determination on whether an installation meets this requirement or not.

3.3 PIPE AND EQUIPMENT SUPPORTS

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels designed by a structural engineer, 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 pipe supports; wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above are prohibited. Replace or thoroughly clean rusty products and paint with zinc primer.

C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 13 mm (1/2 inch) clearance between pipe or piping covering and adjacent work.

D. HVAC Horizontal Pipe Support Spacing: Refer to MSS SP-58. Provide additional supports at valves, strainers, inline pumps and other heavy components. Provide a support within one foot of each elbow.

E. HVAC Vertical Pipe Supports:

1. Up to 152 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. Concrete bases and structural systems shall be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
2. Bases and supports shall not be located and installed until equipment mounted thereon has been approved. Bases shall be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Chiller foundations shall have horizontal dimensions that exceed chiller base frame dimensions by at least 152 mm (6 inches) on all sides. Structural contract documents shall be reviewed for additional requirements. 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.

3.4 MECHANICAL DEMOLITION

A. Rigging access, other than indicated in the contract documents, 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. Debris accumulated

in the area to the detriment of plant operation is prohibited. 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 VAMC, and Contractor shall follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.

C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work shall be completely removed from Government property per Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT. This includes all concrete pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings shall be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with contract documents where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the contract documents of the other disciplines in the project for additional facilities to be demolished or handled.

D. All indicated valves including gate, globe, ball, butterfly and check, all pressure gauges 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 contract documents. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate.

3.5 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. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces

to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.

2. The following material and equipment shall not be painted:
   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. Nameplates.
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, fans, motors, steel and cast-iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same paint type and color as utilized by the pump and fan manufacturer.
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats. This may include painting exposed metals where hangers were removed or where equipment was moved or removed.
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 121 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 (374 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.
8. Lead based paints are prohibited.

3.6 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.

D. Attach ceiling grid label on ceiling grid location directly underneath above ceiling air terminal, control system component, valve, filter unit, fan etc.

3.7 MOTOR AND DRIVES

A. Use synchronous belt drives only on equipment controlled by soft starters or variable frequency drive motor controllers without a bypass contactor. Use V-belt drives on all other applications.

B. Alignment of V-Belt Drives: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.

C. Alignment of Synchronous Belt Drives: Set driving and driven shafts parallel and align so that the corresponding pulley flanges are in the same plane.

D. Alignment of Direct-Connect Drives: Securely mount motor in accurate alignment so that shafts are per coupling manufacturer’s tolerances when both motor and driven machine are operating at normal temperatures.

3.8 STARTUP, TEMPORARY OPERATION AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. Startup of equipment shall be performed as described in equipment specifications. Vibration within specified tolerance shall be verified prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, paragraph TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.9 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS paragraph TESTS, and in individual Division 23 sections 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 or time 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 conduct such performance tests and finalize control settings for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work. Rescheduling of these tests shall be requested in writing to COR for approval.

D. No adjustments shall be made during the acceptance inspection. All adjustments shall have been made by this point.

3.10 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

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SECTION 23 05 12
GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT

PART 1 - ENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation and connection of motors for HVAC and steam generation equipment.

B. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

E. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

F. Section 26 24 19, MOTOR CONTROL CENTERS.

G. Section 26 29 11, MOTOR CONTROLLERS.

1.3 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. Where conflicts occur these specifications and the VHA standards will govern.

B. American Bearing Manufacturers Association (ABMA):

9–2015.....Load Ratings and Fatigue Life for Ball Bearings

11-2014.....Load Ratings and Fatigue Life for Roller Bearings

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

90.1-2019.....Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings

D. Institute of Electrical and Electronics Engineers (IEEE):

112-2017.....Standard Test Procedure for Polyphase Induction Motors and Generators

841-2009.....IEEE Standard for Petroleum and Chemical Industry-Premium-Efficiency, Severe-Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors--Up to and Including 370 kW (500 hp)

E. National Electrical Manufacturers Association (NEMA):
MG 1-2016 (R2019).....Motors and Generators
MG 2–2014.....Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators
250-2020.....Enclosures for Electrical Equipment (1000 Volts Maximum)

F. National Fire Protection Association (NFPA):
70-2020.....National Electrical Code (NEC)

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT”, with applicable paragraph identification.

C. Submit motor submittals with driven equipment.

D. Shop Drawings:
1. Provide documentation to demonstrate compliance with contract documents.
2. Motor nameplate information shall be submitted including electrical ratings, efficiency, bearing data, power factor, frame size, dimensions, mounting details, materials, horsepower, voltage, phase, speed (RPM), enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.

E. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
1. Include complete list indicating all components of the systems.

2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

G. Certification: Two weeks prior to final inspection, unless otherwise noted, certification shall be submitted to the COR stating that the motors have been properly applied, installed, adjusted, lubricated, and tested.

1.5 AS-BUILT DOCUMENTATION

A. Comply with requirements in Paragraph “AS-BUILT DOCUMENTATION” in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 MOTORS

A. For alternating current, fractional and integral horsepower motors, NEMA MG 1 and NEMA MG 2 shall apply.
B. For severe duty TEFC motors, IEEE 841 shall apply.
C. All material and equipment furnished and installation methods shall conform to the requirements of Section 26 29 11, MOTOR CONTROLLERS; and Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide premium efficiency type motors. Unless otherwise specified for a particular application, use electric motors with the following requirements.
D. Single-phase Motors:
1. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC) type. Provide capacitor-start type for hard starting applications.
a. In order to meet ASHRAE 90.1 requirements, motors for small packaged HVAC equipment may be Electrically Commutated motor (EC type). Motor shall be brushless DC type specifically designed for applications with heavy duty ball bearings and electronic communication. The motor shall be speed controllable down to 20 percent of full speed and 85 percent efficient at all speeds.

E. Voltage ratings shall be as follows:
   1. Single phase:
      a. Motors connected to 120-volt systems: 115 volts.
      b. Motors connected to 208-volt systems: 200 volts.
      c. Motors connected to 240-volt or 480-volt systems: 230/460 volts, dual connection.
   2. Motors, less than 373 W (1/2 hp): Single phase.
   3. Exceptions:
      a. Hermetically sealed motors.
      b. Motors for equipment assemblies, less than 746 W (1 hp), shall be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.
F. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.

G. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting, acceleration, and running torque without exceeding nameplate ratings or considering service factor.
H. Motor Enclosures:
   1. Shall be the NEMA types as specified and/or shown in the contract documents.
   2. Where the types of motor enclosures are not shown in the contract documents, they shall be the NEMA types per NEMA 250, which are most suitable for the environmental conditions where the motors are being installed. Enclosure requirements for certain conditions are as follows:
      a. Motors located outdoors, indoors in wet or high humidity locations, or in unfiltered airstreams shall be totally enclosed type.
      b. Where motors are located in an NEC 511 classified area, provide TEFC explosion proof motor enclosures.
      c. Where motors are located in a corrosive environment, provide TEFC enclosures with corrosion resistant finish.

3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.

I. Electrical Design Requirements:

1. Motors shall be continuous duty.
2. The insulation system shall be rated minimum of Class B, 130 degrees C (266 degrees F).
3. The maximum temperature rise by resistance at rated power shall not exceed Class B limits, 80 degrees C (176 degrees F).
4. The speed/torque and speed/current characteristics shall comply with NEMA Design A or B, as specified.
5. Motors shall be suitable for full voltage starting, unless otherwise noted. Coordinate motor features with applicable motor controllers.
6. Motors for variable frequency drive applications shall adhere to NEMA MG 1, Part 30, Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General-Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both, or NEMA MG 1, Part 31, Definite-Purpose Inverter-Fed Polyphase Motors.

J. Mechanical Design Requirements:

1. Bearings shall be rated in accordance with ABMA 9 or ABMA 11 for a minimum fatigue life of 26,280 hours for belt-driven loads and 100,000 hours for direct-drive loads based on L10 (Basic Rating Life) at full load direct coupled, except vertical high thrust motors which require a 40,000 hours rating. A minimum fatigue life of 40,000 hours is required for VFD drives.
2. Vertical motors shall be capable of withstanding a momentary up thrust of at least 30 percent of normal down thrust.
3. Grease lubricated bearings shall be designed for electric motor use. Grease shall be capable of the temperatures associated with electric motors and shall be compatible with Polyurea based greases.
4. Grease fittings, if provided, shall be Alemite type or equivalent.
5. Oil lubricated bearings, when specified, shall have an externally visible sight glass to view oil level.
6. Vibration shall not exceed 3.8 mm (0.15 inch) per second, unfiltered peak.
7. Noise level shall meet the requirements of the application.

8. Motors on 180 frames and greater shall have provisions for lifting eyes or lugs capable of a safety factor of 5.
9. All external fasteners shall be corrosion resistant.
10. Condensation heaters, when specified, shall keep motor windings at least 5 degrees C (9 degrees F) above ambient temperature.
11. Winding thermostats, when specified shall be normally closed, connected in series.
12. Grounding provisions shall be in the main terminal box.

K. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional cost or time to the Government.
2. Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
   a. Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.
   b. Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.
   c. Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.
4. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
5. Motors utilized with variable frequency drives shall be rated “inverter-duty” per NEMA MG 1, Part 31, Definite-Purpose Inverter-Fed Polyphase Motors. Provide motor shaft grounding apparatus that shall protect bearings from damage from stray currents.

L. Additional requirements for specific motors, as indicated in the other sections listed in Article, RELATED SECTIONS shall also apply.

M. NEMA Premium Efficiency Electric Motors (Motor Efficiencies): All permanently wired polyphase motors of 746 W (1 hp) or more shall meet the minimum full-load efficiencies as indicated in the following table. Motors of 746 W (1 hp) or more with open, drip-proof, or TEFC enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

N. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM, and 3600 RPM. Power factor correction capacitors shall be provided unless the motor meets the 0.90 requirement without it or if the motor is controlled by a variable frequency drive. The power factor correction capacitors shall be able to withstand high voltage transients and power line variations without breakdown.

O. Energy Efficiency of Small Motors (Motor Efficiencies): All motors under 746 W (1 hp) shall meet the requirements of the DOE Small Motor Regulation.

2.2 INSTALLATION

A. Install motors in accordance with manufacturer’s recommendations, the NEC, NEMA, as shown in the contract documents and/or as required by other sections of these specifications.

B. If in the substantiated evaluation of the COR, the installation fails to meet the requirements of the construction documents with respect to function and maintainability, an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

2.3 FIELD TESTS

A. All tests shall be witnessed by the CxA or by the COR.

B. Perform an electric insulation resistance Test using a megohmmeter on all motors after installation, before startup. All shall test free from grounds.

C. Perform Load test in accordance with IEEE 112, Test Method B, to determine freedom from electrical or mechanical defects and compliance with performance data.

D. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

E. All test data shall be complied into a report form for each motor and provided to the contracting officer or their representative.

2.4 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

2.5 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 1 hours/to instruct each VA personnel responsible in operation and maintenance of the system.

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SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. 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.
   9. Document critical paths of flow on reports.

C. Definitions:
   1. Basic TAB used in this Section: Chapter 39, "Testing, Adjusting and Balancing" of 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. TABB: Testing Adjusting and Balancing Bureau.
   6. SMACNA: Sheet Metal and Air Conditioning Contractors’ National Association.
   7. Hydronic Systems: Includes /heating hot water.
   8. Air Systems: Includes all outside air, supply air, return air, exhaust air and relief air systems.
   9. 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 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
G. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
H. Section 23 07 11, HVAC INSULATION.
J. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
K. Section 23 31 00, HVAC DUCTS AND CASINGS.

1.3 APPLICABLE PUBLICATIONS

A. The following publications form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.
B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
2019.....ASHRAE Handbook – HVAC Applications, Chapter 39, Testing, Adjusting, and Balancing and Chapter 49, Noise and Vibration Control
C. Associated Air Balance Council (AABC):
2016.....National Standards for Total System Balance, 7th Edition
D. National Environmental Balancing Bureau (NEBB):
2019.....Procedural Standard for Testing, Adjusting, and Balancing of Environmental Systems, 9th Edition
2015.....Procedural Standard for the Measurement of Sound and Vibration, 2nd Edition
S110-2019.....Whole Building Technical Commissioning of New Construction, 2nd Edition
E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
2002.....HVAC Systems Testing, Adjusting and Balancing, 3rd Edition
2003.....TAB Procedural Guide 1st Edition

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION XX XX XX, SECTION TITLE”, with applicable paragraph identification.

C. 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.

D. For use by the COR staff, submit one complete set of applicable AABC, NEBB or TABB publications that will be the basis of TAB work.

E. Submit the following for review and approval:

1. Design Review Report within 60 days for design-build 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.
7. Include in each report the critical path for each balanced branch (air and hydronic). Every branch shall have at least one terminal device damper 100 percent open.

F. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area with noted critical paths.

1.5 QUALITY ASSURANCE

A. Refer to paragraphs QUALITY ASSURANCE and SUBMITTALS, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC, Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANT and STEAM GENERATION, and Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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, NEBB, or TABB 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 COR and submit another qualified TAB firm for approval. Any agency that has been the subject of disciplinary action by either the AABC, TABB or NEBB within the five (5) 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 TABB 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 COR 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 (5) 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 shall be performed by an approved successor.
4. TAB Specialist shall be identified by the General Contractor within sixty (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 COR. The responsibilities shall specifically include:

a. Directly supervising all TAB work.
b. 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, TABB or NEBB.
c. Following all TAB work through its satisfactory completion.
d. Providing final markings of settings of all HVAC adjustment devices.
e. Permanently mark location of duct test ports.
f. Documenting critical paths from the fan or pump. These critical paths are ones in which are 100 percent open from the fan or pump to the terminal device. This will show the least amount of restriction is being imposed on the system by the TAB firm.

5. All TAB technicians performing actual TAB work shall be experienced and shall have done satisfactory work on a minimum of three (3) projects comparable in size and complexity to this project. Qualifications shall be certified by the TAB agency in writing. The lead technician shall be certified by AABC, TABB or NEBB.

C. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards, TABB/SMACNA International Standards, or by NEBB Procedural Standard 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. All equipment shall remain in calibration, or be re-calibrated if certification expires, during the TAB procedures.

D. TAB Criteria:

1. One or more of the applicable AABC, NEBB, TABB or SMACNA publications, supplemented by Chapter 39, "Testing, Adjusting and Balancing" of ASHRAE Handbook "HVAC Applications" 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 Chapter 39, "Testing, Adjusting and Balancing" of ASHRAE Handbook "HVAC Applications" 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 5 percent to plus l0 percent.
b. Air Terminal Units (maximum values): Minus 5 percent to plus l0 percent
c. Exhaust Hoods/Cabinets: 0 percent to plus l0 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 l0 percent except if the air to air space is 100 CFM or less the tolerance will 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 5 percent to plus 5 percent.
h. Chilled Water Coils: Minus 5 percent to plus 5 percent.

3. Systems shall be adjusted for energy efficient operation as described in PART 3.
4. Typical TAB procedures and critical path results shall be demonstrated to the COR for one air distribution system (including all fans, 3 terminal units, 3 rooms randomly selected by the COR, one of which shall be a critical path) and 1 hydronic system (pumps and 3 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.

PART 2 - PRODUCTS

2.1 PLUGS

A. Provide plastic plugs to seal holes drilled in ductwork for test purposes.

2.2 INSULATION REPAIR MATERIAL

A. 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 Paragraph QUALITY ASSURANCE.

B. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.

3.2 DESIGN REVIEW REPORT

A. The TAB Specialist shall review the contract documents and advise the COR 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 shall be done after air distribution and hydronic equipment is onsite and duct and piping 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 checklist format developed by AABC, NEBB or SMACNA (TABB), 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 DUCT AIR LEAKAGE TEST REPORT

A. TAB Agency shall perform the leakage test as outlined in "Duct Leakage Tests and Repairs" in Section 23 31 00, HVAC DUCTS and CASINGS for TAB agency’s role and responsibilities in witnessing, recording and reporting of deficiencies.

3.5 SYSTEM READINESS REPORT

A. The TAB Contractor shall measure existing air and water flow rates associated with existing systems utilized to serve renovated areas as indicated in the contract documents. Submit report of findings to COR.

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 CxA.

C. Verify that all items such as ductwork piping, dampers, valves, ports, terminals, connectors, etc., that are required for TAB are installed. Provide a report to the COR.

3.6 TAB REPORTS

A. Submit an intermediate report for 50 percent of systems and equipment tested and balanced to establish satisfactory test results.

B. The TAB Contractor shall provide raw data immediately in writing to the COR 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 after engineering and construction have been evaluated 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 COR.

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, TABB or NEBB. Balancing shall be done proportionally to all applicable systems.
   1. At least 1 trunk damper shall be 100 percent open.
   2. At least 1 branch damper shall be 100 percent open per trunk.
   3. At least 1 terminal device duct be 100 percent open per branch.
   4. At least one hydronic balancing valve shall be 100 percent open per hydronic system.

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.

D. Allow 14 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 air-handling units, fans, terminal units, fan coil units, room diffusers/outlets/inlets, computer room AC units, and laboratory fume hoods and biological safety cabinets.

1. Artificially load air filters by partial blanking to produce static 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. Provide new drive sets as required to adjust fan speeds.
3. Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other HVAC controls function properly.
4. Variable Air Volume (VAV) Systems:
   a. Coordinate TAB, including system volumetric controls, with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
   b. Section 23 36 00, AIR TERMINAL UNITS, specifies that maximum and minimum flow rates for air terminal units (ATU) be factory set. Check and readjust ATU flow rates if necessary to meet design criteria. Balance air distribution from ATU on full cooling maximum scheduled cubic meters per minute (cubic feet per minute). Reset room thermostats and check ATU operation from maximum to minimum cooling, to the heating mode, and back to cooling. Record and report the heating coil leaving air temperature when the ATU is in the maximum heating mode. Record and report outdoor air flow rates under all operating conditions (The test shall demonstrate that the minimum outdoor air ventilation rate shall remain constant under all operating conditions).
   c. Adjust operating pressure control setpoint to maintain the design flow to each space with the lowest setpoint.
5. Record final measurements for air handling equipment performance data sheets.
6. Record final damper settings for all manual volume dampers.

G. Water Balance and Equipment Test: Include circulating pumps, convertors, coils, coolers and condensers:
   1. Coordinate water chiller flow balancing with Section 23 64 00, PACKAGED WATER CHILLERS.
   2. Adjust flow rates for equipment. Set coils and evaporator to values on equipment submittals, if different from values in the contract documents.
   3. Primary-Secondary (variable volume) Systems: Coordinate TAB with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. Balance systems at design water flow and then verify that variable flow controls function as designed.
   4. Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for convertors. Include entering and leaving air temperatures (DB/WB for cooling coils) for air-handling units and reheat coils. Make air and water temperature measurements at the same time.
   5. On coils with automatic flow limiting valves (automatic balancing valves) measure and report Delta P across valve and measure Delta P across 100 percent open temperature control valve and using control valve CV calculate and report gpm.
   6. Record final valve setting for all balancing valves.

3.10 MARKING OF SETTINGS

A. 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 COR.

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.

3.13 CRITICAL FLOW PATH

A. Provide a documented critical path for all fluid flows. There shall be at least one (1) terminal device that can be traced back to the fan or pump where there is no damper or valves that are less than 100 percent open.

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SECTION 23 09 23
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. General Contractor shall provide direct-digital control system(s) as indicated on the project documents, point list, interoperability tables, drawings and as described in these specifications. Include a complete and working direct-digital control system. Include all engineering, programming, configuration/setup hardware and software, controls and installation materials, installation labor, commissioning and startup, training, final project documentation and warranty.

1. The direct-digital control system(s) shall consist of high-speed, peer-to-peer network of DDC controllers, a control system server, all configuration and setup software and hardware devices, and an Engineering Control Center. Provide a remote user using a standard HTML 5 web browser to access the control system graphics and change adjustable setpoints with the proper password.
2. All new building controllers shall be native BACnet. All new BACnet workstations, controllers, devices and components shall be listed by BACnet Testing Laboratories. All new BACnet workstations, controllers, devices and components shall be accessible using a HTML5 Web browser interface. Browsers shall not require the use of an extension or add on software in order to access aforementioned workstations, controllers, devices, and components.
3. The work administered by this Section of the technical specifications 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 any other items required for a complete and fully functional Controls System.
4. The control systems shall be designed such that each mechanical system shall operate under stand-alone mode. The A/E shall designate

what each “mechanical systems” is composed of. The contractor administered by this Section of the technical specifications 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.

5. The control system shall accommodate 1 Engineering Control Center(s) and the control system shall accommodate 5 web-based Users simultaneously, and the access to the system should be limited only by operator password.

B. Some products are furnished but not installed by the contractor administered by this Section of the technical specifications. The contractor administered by this Section of the technical specifications shall formally coordinate in writing and receive from other contractors formal acknowledgements in writing prior to submission the installation of the products. These products include but are not limited to the following:

1. Control valves.
2. Flow switches.
3. Flow meters.
4. Sensor wells and sockets in piping.
5. Terminal unit controllers.

C. Some products are installed but not furnished by the contractor administered by this Section of the technical specifications. The contractor administered by this Section of the technical specifications shall formally coordinate in writing and receive from other contractors formal acknowledgements in writing prior to submission the procurement of the products. These products include but are not limited to the following:

1. Factory-furnished accessory thermostats and sensors furnished with unitary equipment.

D. Some products are not provided by, but are nevertheless integrated with the work executed by, the contractor administered by this Section of the technical specifications. These products include but are not limited to the following:

1. Fire alarm systems. If zoned fire alarm is required by the project-specific requirements, this interface shall require multiple relays,

which are provided and installed by the fire alarm system contractor, to be monitored.

2. The following systems have limited control (as individually noted below) from the ECC:
   a. Elevators: status alarms.

E. Responsibility Table:

Work/Item/System	Furnish	Install	Low Voltage Wiring	Line Power
Automatic damper actuators	23 09 23	23 09 23	23 09 23	23 09 23
Manual valves	23	23	N/A	N/A
Automatic valves	23 09 23	23	23 09 23	23 09 23
Pipe insertion devices and taps, flow and pressure stations.	23	23	N/A	N/A
Thermowells	23 09 23	23	N/A	N/A
Smoke detectors	28 31 00	28 31 00	28 31 00	28 31 00
Fire/Smoke Dampers	23	23	28 31 00	28 31 00
Smoke Dampers	23	23	28 31 00	28 31 00
Fire Dampers	23	23	N/A	N/A
VFDs	23	26	23 09 23	26

1. Upgrade the existing direct-digital control system’s ECC to include all properties and services required by an ASHRAE Standard 135 BACnet B-AWS Profile. The upgraded ECC shall continue to communicate with the existing direct-digital control system’s devices. The upgraded ECC shall communicate directly with the new native-BACnet devices over the existing control system’s communications network without the use of a gateway. Provide programming converting the existing non-BACnet devices, objects and services to ASHRAE Standard 135 BACnet-complaint BIBBs. The contractor administered by this Section of the technical specifications shall provide all necessary investigation and site-specific programming to execute the interoperability schedules.
   a. The performance requirement for the combined system: the combined system 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.

F. This campus has standardized on an existing standard ASHRAE Standard 135, BACnet/IP Control System supported by a preselected controls service company. This entity is referred to as the “Control System Integrator” in this Section of the technical specifications. The Control system integrator is responsible for ECC system graphics and expansion. It also prescribes control system-specific commissioning/ verification procedures to the contractor administered by this Section of the technical specification. It lastly provides limited assistance to the contractor administered by this Section of the technical specification in its commissioning/verification work.

1. The General Contractor of this project shall directly hire the Control System Integrator in a contract separate from the contract procuring the controls contractor administered by this Section of the technical specifications.
2. The contractor administered by this Section of the technical specifications shall coordinate all work with the Control System Integrator. The contractor administered by this Section of the technical specifications shall integrate the ASHRAE Standard 135, BACnet/IP control network(s) with the Control System Integrator’s B-AWS through an Ethernet connection provided by either the Control System Integrator or VA.
3. The contractor administered by this Section of the technical specifications shall provide a peer-to-peer networked, stand-alone, distributed control system. This direct digital control (DDC) system at least shall include one portable operator terminal - laptop, one digital display unit, microprocessor-based controllers, instrumentation, end control devices, wiring, piping, software, and related systems. This contractor is responsible for all device mounting and wiring.

4. Responsibility Table:

Item/Task	Section 23 09 23 contactor	Control system integrator	VA
ECC expansion		X	
ECC programming		X	
Devices, controllers, control panels and equipment	X		
Point addressing: all hardware and software points including setpoint, calculated point, data point(analog/ binary), and reset schedule point	X		
Point mapping		X	
Network Programming	X		
ECC Graphics		X	
Controller programming and sequences	X		
Integrity of LAN communications			X
Electrical wiring	X		
Operator system training		X	
LAN connections to devices			X
LAN connections to ECC			X
IP addresses			X
Overall system verification (Cx)		X	
Controller and system verification	X		

G. Unitary standalone systems including Unit Heaters, Cabinet Unit Heaters, Fan Coil Units, Base Board Heaters, thermal comfort ventilation fans, 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. Application of standalone unitary controls is limited to at least those systems wherein remote monitoring, alarm and startup are not necessary. Examples of such systems include:

1. Light-switch-operated toilet exhaust
2. Vestibule heater
3. Exterior stair heater
4. Attic heating and ventilation

5. Mechanical or electrical room heating and ventilation.

H. The direct-digital control system shall start and stop equipment, move (position) damper actuators and valve actuators, and vary speed of equipment to execute the mission of the control system. Use electricity as the motive force for all damper and valve actuators, unless use of pneumatics as motive force is specifically granted in writing by the VA.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

B. Section 13 21 29, Constant Temperature Rooms.

C. Section 23 21 13, Hydronic Piping.

D. Section 23 31 00, HVAC Ducts and Casings.

E. Section 26 05 11, Requirements for Electrical Installations.

F. Section 26 05 21, Low-Voltage Electrical Power Conductors and Cables (600 Volts and Below).

G. Section 26 05 26, Grounding and Bonding for Electrical Systems.

H. Section 26 05 33, Raceway and Boxes for Electrical Systems.

I. Section 26 09 23, Lighting Controls.

J. Section 26 22 21, Specialty Transformers.

K. Section 26 27 26, Wiring Devices.

L. Section 26 29 11, Motor Starters.

M. Section 26 32 13, Engine Generators.

N. Section 27 15 00, Communications Horizontal Cabling

O. Section 28 31 00, Fire Detection and Alarm.

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. Analog: A continuously varying signal value (e.g., temperature, current, velocity etc.

C. BACnet: A Data Communication Protocol for Building Automation and Control Networks -as defined by ANSI/ASHRAE Standard 135. This communications protocol allows diverse building automation devices to communicate data and services over a network.

D. BACnet/IP: Annex J of Standard 135. It defines and allows for using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP

network is a collection of one or more IP sub-networks that share the same BACnet network number.

E. BACnet Internetwork: Two or more BACnet networks connected with routers. The two networks may use different LAN technologies.

F. BACnet Network: One or more BACnet segments that have the same network address and are interconnected by bridges at the physical and data link layers.

G. BACnet Segment: One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.

H. BACnet Broadcast Management Device (BBMD): A communications device which broadcasts BACnet messages to all BACnet/IP devices and other BBMDs connected to the same BACnet/IP network.

I. BACnet Interoperability Building Blocks (BIBBs): BACnet Interoperability Building Blocks (BIBBs) are collections of one or more BACnet services. These are prescribed in terms of an "A" and a "B" device. Both of these devices are nodes on a BACnet internetwork.

J. BACnet Testing Laboratories (BTL). The organization responsible for testing products for compliance with the BACnet standard, operated under the direction of BACnet International.

K. 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.

L. 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.

M. 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

N. 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).

O. Device: a control system component that contains a BACnet Device Object and uses BACnet to communicate with other devices.

P. Device Object: Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object Identifier number on the BACnet internetwork. This number is often referred to as the device instance.

Q. 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.

R. 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.

S. 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.

T. 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.

U. 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.

V. 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.

W. Ethernet: A trademark for a system for exchanging messages between computers on a local area network using coaxial, fiber optic, or twisted-pair cables.

X. Firmware: Firmware is software programmed into read only memory (ROM) chips. Software may not be changed without physically altering the chip.

Y. Gateway: Communication hardware connecting two or more different protocols. It translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a gateway has BACnet on one side and non-BACnet (usually proprietary) protocols on the other side.

Z. GIF: Abbreviation of Graphic interchange format.

AA. 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.

BB. Graphic Sequence of Operation: It is a graphical representation of the sequence of operation, showing all inputs and output logical blocks.

CC. 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.

DD. I/P: a method for conveying and routing packets of information over LAN paths. User Datagram Protocol (UDP) conveys information to “sockets” without confirmation of receipt. Transmission Control Protocol (TCP) establishes "sessions", which have end-to-end confirmation and guaranteed sequence of delivery.

EE. JPEG: A standardized image compression mechanism stands for Joint Photographic Experts Group, the original name of the committee that wrote the standard.

FF. Native BACnet Device: A device that uses BACnet as its primary method of communication with other BACnet devices without intermediary gateways. A system that uses native BACnet devices at all levels is a native BACnet system.

GG. Network Number: A site-specific number assigned to each network segment to identify for routing. This network number must be unique throughout the BACnet internetwork.

HH. Object: The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.

II. Operating system (OS): Software, which controls the execution of computer application programs.

JJ. 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.

KK. Peripheral: Different components that make the control system function as one unit. Peripherals include monitor, printer, and I/O unit.

LL. Sensors: devices measuring state points or flows, which are then transmitted back to the DDC system.

MM. Thermostats : devices measuring temperatures, which are used in control of standalone or unitary systems and equipment not attached to the DDC system.

1.4 QUALITY ASSURANCE

A. Criteria:

1. Single Source Responsibility of subcontractor: Either the DDC Contractor or the System Integrator shall obtain hardware and software supplied under this Section and delegate the responsibility to a single source controls installation subcontractor. The Integration subcontractor shall be responsible for the complete design, installation, integration, 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.
2. 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.
3. 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 could observe the control systems in full operation.
4. The controls subcontractor shall have an 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.
5. The controls subcontractor shall have minimum of three years of experience in design and installation of building automation systems similar in performance to those specified in this Section.

6. 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.

1.5 PERFORMANCE

A. The system shall conform to the following:

1. Graphic Display: The system shall display up to four (4) graphics on a single screen with a minimum of twenty (20) dynamic points per graphic. All current data shall be displayed within ten (10) seconds of the request.
2. Graphic Refresh: The system shall update all dynamic points with current data within eight (8) 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 two(2) seconds. Analog objects shall start to adjust within two (2) 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 six (6) 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. Multiple Alarm Annunciations: All workstations on the network shall receive alarms within five (5) seconds of each other.
8. Performance: Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every one (1) second. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
9. Reporting Accuracy: Listed below are minimum acceptable reporting end-to-end accuracies for all values reported by the specified system:

Measured Variable	Reported Accuracy
Space temperature	±0.5 degrees C (±1 degrees F)
Ducted air temperature	±0.5 degrees C [±1 degrees F]
Outdoor air temperature	±1.0 degrees C [±2 degrees F]
Relative humidity	±2 percent RH
Water flow	±1 percent of reading

Note 1: for both absolute and differential pressure

10. Control stability and accuracy: Control sequences shall maintain measured variable at setpoint within the following tolerances:

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±50 Pa (±0.2 inch wg)	0–1.5 kPa (0–6 inch wg)
Air Pressure	±3 Pa (±0.01 inch wg)	-25 to 25 Pa (-0.1 to 0.1 inch wg)
Airflow	±10 percent of full scale	
Space Temperature	±1.0ºC (±2.0 degrees F)	
Humidity	±5 percent RH	MRI, SPS, PHARMACY

11. Extent of direct digital control: control design shall allow for at least the points indicated on the points lists on the drawings.

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. The on-line support service shall allow the Controls supplier to dial out over telephone lines to or connect via (through password-limited access) VPN through the internet to monitor and control the facility's building automation system. This remote connection to the facility shall be within two (2) hours of the time that the problem is reported. This coverage shall include normal business hours, after business hours, weekend and holidays. If the problem cannot be resolved with on-line support services, the Controls supplier shall dispatch the qualified personnel to the job site to resolve the problem within 8hours after the problem is reported.

D. Controls 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. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC", with applicable paragraph identification.

C. Manufacturer's Literature and Data Including:

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. Control air-supply components, and computations for sizing compressors, receivers and main air-piping, if pneumatic controls are furnished.
5. Catalog cut sheets of all equipment used. This includes, but is not limited to software (by manufacturer and by third parties), 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.
6. Sequence of operations for each system and the associated control diagrams. Equipment and control labels shall correspond to those shown on the drawings.
7. Color prints of proposed graphics with a list of points for display.
8. Furnish a BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet-compliant device.
9. Schematic wiring diagrams for all control, communication and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers’ model numbers and functions. Show all interface wiring to the control system.
10. An instrumentation list for each controlled system. Each element of the controlled system shall be listed in table format. The table shall show element name, type of device, manufacturer, model number, and product data sheet number.
11. Riser diagrams of wiring between central control unit (CCU) and all control panels.
12. Plan drawings showing routing of LAN and locations of control panels, controllers, routers, gateways, ECC, and larger controlled devices.

13. Construction details for all installed conduit, cabling, raceway, cabinets, and similar. Construction details of all penetrations and their protection.
14. Quantities of submitted items may be reviewed but it is the responsibility of the contractor administered by this Section of the technical specifications to provide sufficient quantities for a complete and working system.

D. Product Certificates: Compliance with Article, QUALITY ASSURANCE.

E. Validation Test Plan: Along with manufacturer’s literature, product certificates, wiring and functional diagrams, and sequence of operations, submit for review and approval a Validation Test Plan which is specific to the work of this project and which references the specific controls component nomenclatures found in the control contractor’s wiring and functional diagrams and the specific sequences of controls for this project and which describes how the contractor will implement the controls system validation and demonstration as specified in paragraph 3.2 SYSTEM VALIDATION AND DEMONSTRATION found in this section.

F. Licenses: Provide licenses for all software residing on and used by the Controls Systems, ECC, and portable OWS and transfer these licenses to the Owner prior to completion.

G. 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) 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.

H. 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. 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.

h. Licenses, guaranty, and other pertaining documents for all equipment and systems.

I. Submit Performance Report to COR prior to final inspection.

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. Where conflicts occur these specifications and the VHA standards will govern.

B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):

135-2020.....BACnet A Data Communication Protocol for Building Automation and Control Networks

147-2019.....Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems

C. Federal Communication Commission (FCC):
Rules and Regulations Title 47 Chapter 1-2014 Part 15: Radio Frequency Devices

D. Institute of Electrical and Electronic Engineers (IEEE):
802.3-2018.....Standard for Ethernet

E. National Fire Protection Association (NFPA):
70-2020.....National Electric Code

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use new products that the manufacturer is currently manufacturing and that have been installed in a minimum of 25 installations. Spare parts shall

2.2 COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.

1. The Data link / physical layer protocol between the ECC and all B-BC’s (for communication) acceptable to the VA throughout its facilities is Ethernet (ISO 8802-3) and BACnet/IP.

2.3 ENGINEERING CONTROL CENTER (ECC)

A. The ECC shall reside on a high-speed network with controllers as shown on system drawings. The ECC and each standard browser connected to server shall be able to access all system information.

B. ECC and controllers shall communicate using BACnet protocol. ECC and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ASHRAE/ANSI 135, BACnet Annex J.

C. Hardware: ECC shall conform to the BACnet Advanced Workstation (B-AWS) Profile and shall be BTL-Listed as a B-AWS device.

1. ECC shall be based on commercially available server grade hardware. Computers based on desktop architectures shall not be permitted. ECC shall have remote management capabilities.
2. Processor(s):
   a. Processors shall be either Intel Xeon or AMD EPYC chips sets designed specifically for server use. Desktop processors will not be allowed.

b. Minimum core count shall be 16 cores. Each Core shall be capable of executing 2 threads simultaneously.
c. Minimum base clock speed shall be 3.0 GHz

3. Memory:
   a. Engineering Control Center shall be equipped with a minimum of 32G of DDR4 Error Correcting Code (ECC) memory. After installation of required 32G of RAM, the motherboard must still have a minimum of 2 DIMM slots open for expansion. Motherboard shall be capable of minimum of 64GB of ECC memory.
   b. Minimum speed shall be 2133MHz for memory
4. Storage:
   a. ECC shall be equipped with a RAID capable drive controller capable of handling at least 8 internal, hot swappable drives.
   b. All installed drives shall be “Enterprise Class” drives designed specifically for server use.
   c. Minimum configuration shall consist of 6 drives in 2 separate RAID arrays:
      1) The operating system shall be stored on a RAID 1 array compromising of 2 drives with each drive having a minimum capacity of 1TB each.
      2) The B-AWS software and all its related databases shall be stored in RAID 5 array consisting of 4 drives with each drive have a minimum of 4TB capacity for a minimum storage capacity of 12TB’s.
      3) An alternative configuration for the 2 RAID arrays described above is 8 drives arrayed in a RAID 10 configuration. In this case the OS RAID array would consist of 4 drives of 1TB minimum each, and the B-AWS RAID array consisting of 4 drives of 16TB minimum each. This configuration would provide faster write times and much quicker rebuild times in the event of a drive failure.
   d. ECC will include an 16X DVD R/W drive
5. Case:
   a. Case shall have space for a minimum of 8 hot swap 3.5 inch hard drives and one internal optical drive
   b. Real-time clock:

1) Accuracy: Plus or minus 1 minute per month.
2) Time Keeping Format: 24-hour time format including seconds, minutes, hours, date, day, and month; automatic reset by software.
3) Clock shall function for one year without power.
4) Provide automatic time correction once every 24 hours by synchronizing clock with the Time Service Department of the U.S. Naval Observatory.

c. Serial ports: Four USB ports and two RS-232-F serial ports for general use, with additional ports as required. Data transmission rates shall be selectable under program control.
d. Parallel port: Enhanced.
e. Sound card: For playback and recording of digital WAV sound files associated with audible warning and alarm functions.
f. Color monitor: PC compatible, not less than 22 inches, LCD type, with a minimum resolution of 1280 by 1024 pixels, non-interlaced, and a maximum dot pitch of 0.28 mm.
g. Keyboard: Minimum of 64 characters, standard ASCII character set based on ANSI INCITS 154.
h. Mouse: Standard, compatible with installed software.
i. Removable disk storage: Include the following, each with appropriate controller:
   1) Minimum 1 TB removable hard disk, maximum average access time of 10 ms.
j. Network interface card (NIC): integrated 10-100-1000 Base-TX Ethernet NIC with an RJ45 connector or a 100Base-FX Ethernet NIC with an SC/ST connector.

6. Provide for automatic system database save and restore on the ECC’s hard disk a copy of the current database of each Controller. This database shall be updated whenever a change is made in any system panel. In the event of a database loss in a building management panel, the ECC shall automatically restore the database for that panel. This capability may be disabled by the operator.
7. Provide for manual database save and restore. An operator with proper clearance shall be able to save the database from any system panel. The operator also shall be able to clear a panel database and

manually initiate a download of a specified database to any panel in the system.

8. Provide a method of configuring the system. This shall allow for future system changes or additions by users with proper clearance.
9. Operating System. Furnish a concurrent multi-tasking operating system. The operating system also shall support the use of other common software applications. Acceptable operating systems are Windows Server 2019, Linux, and UNIX.
10. System Graphics. The operator workstation software shall be graphically oriented. The system shall allow display of up to 10 graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while on-line. An operator with the proper password level shall be able to add, delete, or change dynamic objects on a graphic. Dynamic objects shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation by shifting image files based on the status of the object.
11. Custom Graphics. Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system that uses the mouse to create and modify graphics that are saved in industry standard formats such as PCX, TIFF, and GEM. The graphics generation package also shall provide the capability of capturing or converting graphics from other programs such as Designer or AutoCAD.
12. Graphics Library. Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library also shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.
13. 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. The operating system shall be Windows 10 latest version, or better, and shall support the third party software.

14. 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.
15. 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.
16. On-Line Help. Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.
17. Graphic Displays:
    a. 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.
    b. System Graphics shall be project specific and schematically correct for each system. (i.e.: coils, fans, dampers located per equipment supplied with project.) Standard system graphics that do not match equipment or system configurations are prohibited. Operator shall have capability to manually operate the entire system from each graphic screen at the ECC. Each system graphic shall include a button/tab to a display of the applicable sequence of operation.

c. 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.
d. Color shall be used to indicate status and change in status of the equipment. The state colors shall be user definable.
e. 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.
f. A dynamic display of the site-specific architecture showing status of the controllers, the ECC and network shall be provided.
g. 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.

18. 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:
    a. A general list of all selected points in the network.
    b. List of all points in the alarm.
    c. List of all points in the override status.
    d. List of all disabled points.
    e. List of weekly schedules.
    f. List of holiday programming.
    g. List of limits and dead bands.
    h. Custom reports.
    i. System diagnostic reports, including, list of digital controllers on the network.

j. List of programs.

19. ASHRAE Standard 147 Report: Provide a daily report that shows the operating condition of each chiller as recommended by ASHRAE Standard 147. At a minimum, this report shall include:
    a. Chilled water (or other secondary coolant) inlet and outlet temperature
    b. Chilled water (or other secondary coolant) flow
    c. Chilled water (or other secondary coolant) inlet and outlet pressures
    d. Motor amperes per phase
    e. Motor volts per phase
    f. Ambient temperature (dry-bulb and wet-bulb)
    g. Date and time logged
20. Scheduling and Override:
    a. Provide override access through menu selection from the graphical interface and through a function key.
    b. Provide a calendar type format for time-of-day scheduling and overrides of building control systems. Schedules reside in the ECC. The digital controllers shall ensure equipment time scheduling when the ECC is off-line. The ECC shall not be required to execute time scheduling. Provide the following spreadsheet graphics as a minimum:
        1) Weekly schedules.
        2) Zone schedules, minimum of 100 zones.
        3) Scheduling up to 365 days in advance.
        4) Scheduled reports to print at workstation.
21. Collection and Analysis of Historical Data:
    a. Provide trending capabilities that will allow the operator to monitor and store records of system activity over an extended period. 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.

b. 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.

c. 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.

d. 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.

22. Alarm Management:

a. 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.

b. 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.

c. 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.

d. 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.
e. 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.

23. 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.
24. System Configuration:
    a. 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.
    b. 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

2.4 BACnet DEVICES

A. All BACnet Devices – controllers, gateways, routers, actuators, Operator Displays, and sensors shall conform to BACnet Device Profiles and shall be BACnet Testing Laboratories (BTL) -Listed as conforming to those Device Profiles. Protocol Implementation Conformance Statements (PICSs), describing the BACnet capabilities of the Devices shall be published and available for the Devices through links in the BTL website.

1. BACnet Building Controllers, shall conform to the BACnet B-BC Device Profile, and shall be BTL-Listed as conforming to the B-BC Device Profile. The Device’s PICS shall be submitted.
2. BACnet Advanced Application Controllers shall conform to the BACnet B-AAC Device Profile and shall be BTL-Listed as conforming to the B-AAC Device Profile. The Device’s PICS shall be submitted.
3. BACnet Application Specific Controllers shall conform to the BACnet B-ASC Device Profile and shall be BTL-Listed as conforming to the B-ASC Device Profile. The Device’s PICS shall be submitted.

4. BACnet Smart Actuators shall conform to the BACnet B-SA Device Profile and shall be BTL-Listed as conforming to the B-SA Device Profile. The Device's PICS shall be submitted.
5. BACnet Smart Sensors shall conform to the BACnet B-SS Device Profile and shall be BTL-Listed as conforming to the B-SS Device Profile. The Device's PICS shall be submitted.
6. BACnet routers and gateways shall conform to the BACnet B-OTH Device Profile, and shall be BTL-Listed as conforming to the B-OTH Device Profile. The Device's PICS shall be submitted.

2.5 CONTROLLERS

A. General. Provide an adequate number of BTL listed B-BC building controllers, BTL listed B-AAC, BTL listed B-ASC, BTL listed B-SA, and BTL listed B-SS's to achieve the performance specified in the Part 1 Article on "System Performance." Each of these controllers shall meet the following requirements.

1. Communication.
   a. Each B-BC controller shall reside on a BACnet network using the ISO 8802-3 (Ethernet) Data Link/Physical layer protocol for its communications.
   b. Each B-BC controller shall provide a service communication port using BACnet Data Link/Physical layer protocol for connection to a portable operator's terminal. If this port is not available built into the controller, contractor is to install a 4 port unmanaged switch inside the B-BC control cabinet.
2. Keypad. A local keypad and display shall be provided for each controller. The keypad shall be provided for interrogating and editing data. Provide a system security password to prevent unauthorized use of the keypad and display.
3. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
4. Memory. The controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
5. The controller shall be able to operate at 90 percent to 110 percent of nominal voltage rating and shall perform an orderly shutdown less

than 80 percent nominal voltage. Controller operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 watt at 1 meter (3 feet).

6. Transformer. Power supply for the ASC must be rated at a minimum of 125 percent of B-ASC power consumption and shall be of the fused or current limiting type.

B. Direct Digital Controller Software

1. 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 DOSor Microsoft Windows.
2. 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 ECC.
3. All control functions shall execute within the stand-alone control units. All new controllers installed will also include all software and/or hardware required to program, commission, or alter the sequence of operation of said controller(s). Controllers requiring software or hardware that is not commercially available will not be allowed. Installation of software and/or hardware for controller configuration will be the responsibility of the DDC contractor. COR will direct to install said hardware and/or software on either the B-AWS or portable operator terminal. 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 without requiring the services of a DDC contractor.
4. All controllers 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. Each ACU and RCU shall have capability for local readouts of all functions. The UCUs shall be read remotely.

5. All DDC control loops shall be able to utilize any of the following control modes:
   a. Two position (on-off, slow-fast) control.
   b. Proportional control.
   c. Proportional plus integral (PI) control.
   d. 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.
   e. Automatic tuning of control loops.
6. Application Software: The controllers 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 ECC or via a portable operator’s terminal, when it is necessary, to access directly the programmable unit.
   a. Economizer: An economizer program shall be provided for VAV systems. This program shall control the position of air handler relief, return, and outdoor 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.
   b. 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 the ECC.

c. 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:
   1) Time, day.
   2) Commands such as on, off, auto.
   3) Time delays between successive commands.
   4) Manual overriding of each schedule.
   5) Allow operator intervention.

d. 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 ECC 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.

e. Remote Communications: The system shall have the ability to dial out in the event of an alarm to the ECC 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.

f. 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.

2.6 CONTROL CABLES

A. General:

1. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments. Comply with Sections 27 05 26 and 26 05 26.
2. Cable conductors to provide protection against induction in circuits. Crosstalk attenuation within the System shall be in excess of -80 dB throughout the frequency ranges specified.
3. Minimize the radiation of RF noise generated by the System equipment so as not to interfere with any audio, video, data, computer main distribution frame (MDF), telephone customer service unit (CSU), and electronic private branch exchange (EPBX) equipment the System may service.
4. The as-installed drawings shall identify each cable as labeled, used cable, and bad cable pairs.
5. Label system’s cables on each end. Test and certify cables in writing to the VA before conducting proof-of-performance testing. Minimum cable test requirements are for impedance compliance, inductance, capacitance, signal level compliance, opens, shorts, cross talk, noise, and distortion, and split pairs on all cables in the frequency ranges used. Make available all cable installation and test records at demonstration to the VA. All changes (used pair, failed pair, etc.) shall be posted in these records as the change occurs.

6. Power wiring shall not be run in conduit with communications trunk wiring or signal or control wiring operating at 100 volts or less.

B. Analogue control cabling shall be not less than No. 18 AWG solid or stranded, with thermoplastic insulated conductors as specified in Section 26 05 21.

C. Copper digital communication cable between the ECC and the B-BC and B-AAC controllers shall be 100BASE-TX Ethernet, Category 5e or 6, not less than minimum 24 American Wire Gauge (AWG) solid, Shielded Twisted Pair (STP) or Unshielded Twisted Pair (UTP), with thermoplastic insulated conductors, enclosed in a thermoplastic outer jacket, as specified in Section 27 15 00.

1. Other types of media commonly used within IEEE Std 802.3 LANs (e.g., 10Base-T and 10Base-2) shall be used only in cases to interconnect with existing media.

D. All MS/TP communications cables for devices utilizing the EIA-485 standard must be listed for use on EIA-485 networks by the manufacturer of the cable. This requirement overrides any cable recommendation by the controller manufacturer. The use of EIA-485 communication cables shall not affect the warranty from the installing DDC contractor. Cables shall have the following characteristic:

1. Nominal Impedance: 100-130 Ohms
2. Twisted/shielded construction of 1, 1.5, or 2 pairs depending on controller requirements.
3. Be plenum rated when required
4. Cables designated for use by the cable manufacturer for use in PA or Speaker systems shall not be allowed, regardless of recommendations by the controller manufacturer.

E. Optical digital communication fiber, if used, shall be Multimode or Single mode fiber, 62.5/125 micron for multimode or 10/125 micron for single mode micron with SC or ST connectors as specified in TIA-568-C.1. Terminations, patch panels, and other hardware shall be compatible with the specified fiber and shall be as specified in Section 27 15 00. Fiber-optic cable shall be suitable for use with the 100Base-FX or the 100Base-SX standard (as applicable) as defined in IEEE Std 802.3.

2.7 THERMOSTATS AND HUMIDISTATS

A. Room thermostats controlling unitary standalone heating and cooling devices not connected to the DDC system 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, BACnet enabled programmable to daily, weekend, and holiday schedules.
   a. Public Space Thermostat: Public space thermostat shall have a thermistor 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: thermistor with in-space User set point adjustment and an on-casing room temperature numerical temperature display.
   c. Psychiatric Patient Room Sensors: Electronic duct sensor as noted under Article 2.4.
   d. Battery replacement without program loss.

2.8 AIR FLOW CONTROL

A. Airflow and static pressure shall be controlled via digital controllers with inputs from airflow control measuring stations and static pressure inputs as specified. Controller outputs shall be analog or pulse width modulating output signals. The controllers 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.

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 or fan inlet 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.

B. Constant Volume Control 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 or staticpressure 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.

C. Airflow Synchronization:

1. Systems shall consist of an air flow measuring station for each main 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 ±10 percent. 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.

D. contacts and shall be connected to the DDC system for monitoring and sequencing.

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 COR for resolution before proceeding for installation.
2. Install equipment, piping, wiring /conduit parallel to or at right angles to building lines.
3. Install all equipment and piping in readily accessible locations. Do not run tubing and conduit concealed under insulation or inside ducts.
4. Mount control devices, tubing and conduit located on ducts and apparatus with external insulation on standoff support to avoid interference with insulation.
5. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
6. Run tubing and wire connecting devices on or in control cabinets parallel with the sides of the cabinet neatly racked to permit tracing.
7. Install equipment level and plumb.

B. Electrical Wiring Installation:

1. All wiring and cabling shall be installed in conduits. Install conduits and wiring in accordance with Specification Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Conduits carrying control wiring and cabling shall be dedicated to the control wiring and cabling: these conduits shall not carry power wiring. Provide plastic end sleeves at all conduit terminations to protect wiring from burrs.
2. Install analog signal and communication cables in conduit and in accordance with Specification Division 27 – COMMINICATIONS. Install digital communication cables in conduit and in accordance with Specification Section 27 15 00, COMMINICATIONS STRUCTURED CABLING.
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.

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 (less than 50 volt) power is required, provide suitable Class B 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.

C. 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 unless otherwise noted on the plans or drawings.

e. Mount sensors rigidly and adequately for the environment within which the sensor operates. Separate extended-bulb sensors form contact with metal casings and coils using insulated standoffs.

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.

D. 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: 100 Base TX (Category 5e cabling) for the communications between the ECC and the B-BC and the B-AAC controllers.

2. 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.

E. Installation of digital controllers and programming:

1. 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.
2. System point names shall be human readable, permitting easy operator interface without the use of a written point index.
3. 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 be submitted for review with the control system submittal as indicated in paragraph 1.7 Submittals. Test Plan address all specified functions of the ECC 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 ensure 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, CxA or COR on random samples of equipment as dictated by the COR. Should random sampling indicate improper work, the owner reserves the right to subsequently witness complete calibration of the system at no addition cost to the VA.
2. Make accessible, personnel to provide necessary adjustments and corrections to systems as directed by balancing agency.
3. The following witnessed demonstrations of field control equipment shall be included:
   a. Observe HVAC systems in shut down condition. Check dampers and valves for normal position.
   b. Test application software for its ability to communicate with digital controllers, operator workstation, and uploading and downloading of control programs.
   c. Demonstrate the software ability to edit the control program off-line.
   d. Demonstrate reporting of alarm conditions for each alarm and ensure that these alarms are received at the assigned location, including operator workstations.
   e. Demonstrate ability of software program to function for the intended applications-trend reports, change in status etc.
   f. 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.
   g. 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.

h. 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.

i. Demonstrate that each control loop responds to set point adjustment and stabilizes within one 1minute(s). Control loop trend data shall be instantaneous and the time between data points shall not be greater than one (1) minute.

3.3 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

----- END -----

SECTION 23 21 13
HYDRONIC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Water piping to connect HVAC equipment, including the following:
   1. Chilled water, condenser water, heating hot water and drain piping.
   2. Extension of domestic water make-up piping for HVAC systems.
   3. Glycol-water piping.

B. A complete listing of common acronyms and abbreviations are included in Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANT AND STEAM GENERATION.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

E. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

F. Section 23 07 11, HVAC INSULATION.

G. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

1.3 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. Where conflicts occur these specifications and the VHA standard will govern.

B. American Society of Mechanical Engineers (ASME):

B1.20.1-2013.....Pipe Threads, General Purpose, Inch

B16.3-2016.....Malleable Iron Threaded Fittings: Classes 150 and 300

B16.4-2016.....Gray Iron Threaded Fittings: (Classes 125 and 250)

B16.5-2020.....Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard

B16.9-2018.....Factory Made Wrought Buttwelding Fittings

B16.11-2016.....Forged Fittings, Socket-Welding and Threaded

B16.18-2018.....Cast Copper Alloy Solder Joint Pressure Fittings

B16.22-2018.....Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

B16.24-2016.....Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500

B16.39-2019.....Malleable Iron Threaded Pipe Unions: Classes 150, 250, and 300

B16.42-2016.....Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300

B31.9-2020.....Building Services Piping

B40.100-2013.....Pressure Gauges and Gauge Attachments

ASME Boiler and Pressure Vessel Code (BPVC):

BPVC Section VIII-2021..Rules for Construction of Pressure Vessels, Division 1

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

A47/A47M-1999(R2018)e1..Standard Specification for Ferritic Malleable Iron Castings

A53/A53M-2020.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

A106/A106M-2019a.....Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service

A126-2004(R2019).....Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

A183-2014(R2020).....Standard Specification for Carbon Steel Track Bolts and Nuts

A216/A216M-2021.....Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

A307-2021.....Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength

A536-1984(R2019e1).....Standard Specification for Ductile Iron Castings

B62-2017.....Standard Specification for Composition Bronze or Ounce Metal Castings

B88-2020.....Standard Specification for Seamless Copper Water Tube

F439-2019.....Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80

F441/F441M-2020.....Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

D. American Welding Society (AWS):

B2.1/B2.1M-2014.....Specification for Welding Procedure and Performance Qualification

E. Expansion Joint Manufacturer’s Association, Inc. (EJMA):

EJMA 2017.....Standards of the Expansion Joint Manufacturers Association, Tenth Edition

F. Manufacturers Standardization Society (MSS) of the Valve and Fitting Industry, Inc.:

SP-67-2017.....Butterfly Valves

SP-70-2011.....Gray Iron Gate Valves, Flanged and Threaded Ends

SP-71-2018.....Gray Iron Swing Check Valves, Flanged and Threaded Ends

SP-80-2019.....Bronze Gate, Globe, Angle, and Check Valves

SP-85-2011.....Gray Iron Globe and Angle Valves, Flanged and Threaded Ends

SP-110-2010.....Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

SP-125-2018.....Check Valves: Gray Iron and Ductile Iron, In-line, Spring-Loaded, Center-Guided

G. National Fire Protection Association (NFPA):

70-2020.....National Electrical Code (NEC)

H. Tubular Exchanger Manufacturers Association (TEMA):

TEMA Standards 2019.....10th Edition

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 21 13, HYDRONIC PIPING”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

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. Couplings and fittings.
6. Valves of all types.
7. Strainers.
8. Flexible connectors for water service.
9. Pipe alignment guides.
10. Water flow measuring devices.
11. Gauges.
12. Thermometers and test wells.

D. Manufacturer's certified data report, Form No. U-1, for ASME pressure vessels:

E. Submit the welder’s qualifications in the form of a current (less than 1-year old) and formal certificate.

F. Coordination Drawings: Refer to paragraph, SUBMITTALS of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. As-Built Piping Diagrams: Provide drawings as follows for chilled water, condenser water, and heating hot water system and other piping systems and equipment.

1. 1wall-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. 1 complete set of reproducible drawings.
3. 1 complete set of drawings in electronic AutoCAD and pdf format.

H. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

1.5 QUALITY ASSURANCE

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC, 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 1-year old.
C. All couplings, fittings, valves, and specialties shall be the products of a single manufacturer.
1. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.
D. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.
E. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.7 SPARE PARTS

A. For mechanical pressed sealed fittings provide tools required for each pipe size used at the facility.

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.

2.2 PIPE AND TUBING

A. Heating Hot Waterand Vent Piping:
   1. Steel: ASTM A53/A53M Grade B, seamless or ERW, Schedule 40.
   2. Copper Water Tube Option: ASTM B88, Type K or L, hard drawn.Soft drawn tubing, 19 mm (3/4 inch) and larger, shall be used for runouts routed under slab to floor mounted fan coil units.
B. Extension of Domestic Water Make-up Piping: ASTM B88, Type K or L, hard drawn copper tubing.
C. Cooling Coil Condensate Drain Piping:
   1. From Air Handling Units: Copper water tube, ASTM B88, Type M, or Schedule 40 PVC plastic piping. Use of PVC piping is prohibited in exterior applications.
   2. From Fan Coil or Other Terminal Units: Copper water tube, ASTM B88, Type M for runouts and Type L for mains.
D. Chemical Feed Piping for Condenser Water Treatment: CPVC, Schedule 80, ASTM F441/F441M.
E. Pipe supports, including insulation shields, for aboveground piping: Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

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 prohibited.
   4. Unions: ASME B16.39.
   5. Water Hose Connection Adapter: Brass, pipe thread to 19 mm (3/4 inch) garden hose thread, with hose cap nut.
B. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and threadolets shall be used for branch connections up to 1

pipe size smaller than the main. Forged steel half-couplings, ASME B16.11 shall be used for drain, vent, and gauge connections.

2.4 FITTINGS FOR COPPER TUBING

A. Joints:
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.

B. Bronze Flanges and Flanged Fittings: ASME B16.24.

C. Fittings: ASME B16.18 cast copper or ASME B16.22 solder wrought copper.

2.5 SCREWED JOINTS

A. Pipe Thread: ASME B1.20.1.

B. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

2.6 VALVES

A. Asbestos packing is prohibited.

B. All valves of the same type shall be products of a single manufacturer.

C. Provide chain operators for valves 152 mm (6 inches) and larger when the centerline is located 2.4 m (8 feet) or more above the floor or operating platform.

D. Shut-Off Valves:

1. Ball Valves (Pipe Sizes 50 mm (2 inch) and Smaller): MSS SP-110, screwed or solder connections, Stainless steel with chrome-plated ball with full port and Teflon seat at 2758 kPa (400 psigworking pressure rating. Provide stem extension to allow operation without interfering with pipe insulation.

2. Field Interchangeable Actuators: Valves for balancing service shall have adjustable memory stop to limit open position.

a. Valves 152 mm (6 inches) and Smaller: Lever actuator with minimum of seven locking positions, except where chain wheel is required.

E. Check Valves:

1. Swing Check Valves:

a. 50 mm (2 inches) and Smaller: MSS SP-80, stainless steel, 1034 kPa (150 psig), 45-degree swing disc.

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/A216M, Class WCB, or ductile iron, ASTM 536, flanged or wafer type.

b. Seat, Disc and Spring: 18-8 stainless-steel, or bronze, ASTM B62. Seats may be elastomer material.

F. Water Flow Balancing Valves: For flow regulation. Provide separate isolation valve. Valves shall be sized to provide the needed pressure drop in the middle of their throttling range.

1. Ball 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.

G. Automatic Balancing Control Valves: Factory calibrated to maintain constant flow (plus or minus five percent) over system pressure fluctuations of 28 to 393 kPa (4 to 57 psig). Provide standard pressure taps and 4 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 1200 kPa (175 psig) at 93 degrees C (200 degrees F), with stainless-steel piston and spring.
2. Brass or ferrous body designed for 2070 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.
4. Provide a readout kit including flow meter, probes, hoses, flow charts and carrying case.

H. Manual Radiator/Convector Valves: Brass, packless, with position indicator.

2.7 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 (1/8 inch) diameter perforations.

B. Suction Diffusers: Specified in Section 23 21 23, HYDRONIC PUMPS.

2.8 FLEXIBLE CONNECTORS FOR WATER SERVICE

A. Flanged Spool Connector:

1. Single arch or multiple arch type. Tube and cover shall be constructed of chlorobutyl elastomer with full faced integral flanges to provide a tight seal without gaskets. Connectors shall be internally reinforced with high strength synthetic fibers impregnated with rubber or synthetic compounds as recommended by connector manufacturer, and steel reinforcing rings.
2. Working pressures and temperatures shall be as follows:
   a. Connector sizes 50 mm to 100 mm (2 inches to 4 inches), 1137 kPa (165 psig) at 121 degrees C (250 degrees F).
3. Provide ductile iron retaining rings and control units.

B. Braided Hose: Corrugated-metal inner hose and braided outer shell.

1. Piping Up To 50 mm (2 inches): Bronze hoses and single-braid bronze sheaths with 3102 kPa at 21 degrees C (450 psig at 70 degrees F) and 2344 kPa at 232 degrees C (340 psig at 450 degrees F) ratings.

2.9 GAUGES, PRESSURE AND COMPOUND

A. ASME B40.100, Accuracy Grade 1A, (pressure, vacuum, or compound for air, oil or water), initial mid-scale accuracy 1 percent of scale (Qualify grade), metal or phenolic case, 114 mm (4-1/2 inches) in diameter, 6 mm (1/4 inch) NPT bottom connection, white dial with black graduations and pointer, clear glass or acrylic plastic window, suitable for board mounting. Provide red "set hand" to indicate normal working pressure.

B. Provide brass lever handle union cock. Provide brass/bronze pressure snubber for gauges in water service.

C. Range of Gauges: Provide range equal to at least 130 percent of normal operating range.

1. For Condenser Water Suction (Compound): 101 kPa (29.5 inches Hg) to 689 kPa (100 psig).

2.10 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 gauge test connections shown in the contract documents.

B. Provide one each of the following test items to the COR:

1. 6 mm (1/4 inch) FPT by 3.2 mm (1/8 inch) diameter stainless-steel pressure gauge adapter probe for extra-long test plug.
2. 89 mm (3-1/2 inch) diameter, one percent accuracy, compound gauge, 101 kPa (29.5 inches Hg) to 689 kPa (100 psig) range.
3. 0 to 104 degrees C (32 to 220 degrees F) pocket thermometer 1/2-degree accuracy, 25 mm (1 inch) dial, 127 mm (5 inch) long stainless-steel stem, plastic case.

2.11 THERMOMETERS

A. Mercury or organic liquid filled type, red or blue column, clear plastic window, with 152 mm (6 inch) brass stem, straight, fixed or adjustable angle as required for each in reading.

B. Case: Chrome plated brass or aluminum with enamel finish.

C. Scale: Not less than 228 mm (9 inches), range as described below, 2-degree graduations.

D. Separable Socket (Well): Brass, extension neck type to clear pipe insulation.

E. Scale Ranges:

1. Hot Water and Glycol-Water: 38 to 93 degrees C (100 to 200 degrees F).

2.12 FIRESTOPPING MATERIAL

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

B. The contract documents 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 or time 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 in the contract documents shall be altered by contractor where necessary to avoid interferences and clearance difficulties.

C. 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.

D. Support piping securely. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Install heat exchangers at height sufficient to provide gravity flow of condensate to the flash tank and condensate pump.

E. Install piping generally parallel to walls and column center lines, unless shown otherwise in the contract documents. Space piping, including insulation, to provide 25 mm (1 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 (1 inch) in 12 m (40 feet). Provide eccentric reducers to keep bottom of sloped piping flat.

F. 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 in the contract documents. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.

G. 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 in the contract documents.

H. 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.

I. 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.

J. Connect piping to equipment as shown in the contract documents. 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.

K. Thermometer Wells: In pipes 63 mm (2-1/2 inches) and smaller increase the pipe size to provide free area equal to the upstream pipe area.

L. 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 AND BOILER PLANT INSULATION.

M. 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 B31.9 and AWS B2.1/B2.1M. See Welder’s qualification requirements in paragraph QUALITY ASSURANCE of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Screwed: Threads shall conform to ASME B1.20.1; joint compound shall be applied to male threads only and joints made up so no more than 3 threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.

C. 125 Pound Cast-Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast-iron flange.

D. Solvent Welded Joints: As recommended by the manufacturer.

3.3 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 shall 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.

3.4 FLUSHING AND CLEANING PIPING SYSTEMS

A. Water Piping: Clean systems as recommended by the suppliers of chemicals specified in Section 23 25 00, HVAC WATER TREATMENT.

B. Initial Flushing: Remove loose dirt, mill scale, metal chips, weld beads, rust, and like deleterious substances without damage to any system component. Provide temporary piping or hose to bypass coils, control valves, exchangers and other factory cleaned equipment unless acceptable means of protection are provided and subsequent inspection of hide-out areas takes place. Isolate or protect clean system components, including pumps and pressure vessels, and remove any component which may be damaged. Open all valves, drains, vents and strainers at all system levels. Remove plugs, caps, spool pieces, and components to facilitate early debris discharge from system. Sectionalize system to obtain debris carrying velocity of 1.8 m/s (5.9 f/s), if possible. Connect dead-end supply and return headers as necessary. Flush bottoms of risers. Install temporary strainers where necessary to protect down-stream equipment. Supply and remove flushing water and drainage by various type hose, temporary and permanent piping and Contractor's booster pumps. Flush until clean as approved by the COR.

C. Cleaning: Using products supplied in Section 23 25 00, HVAC WATER TREATMENT, circulate systems at normal temperature to remove adherent organic soil, hydrocarbons, flux, pipe mill varnish, pipe joint compounds, iron oxide, and like deleterious substances not removed by flushing, without chemical or mechanical damage to any system component. Removal of tightly adherent mill scale is not required. Keep isolated equipment which is "clean" and where dead-end debris accumulation cannot occur. Sectionalize system, if possible, to circulate at velocities not less than 1.8 m/s (5.9 f/s). Circulate each section for not less than 4 hours. Blow-down all strainers or remove

and clean as frequently as necessary. Drain and prepare for final flushing.

D. Final Flushing: Return systems to conditions required by initial flushing after all cleaning solution has been displaced by clean make-up. Flush all dead ends and isolated clean equipment. Gently operate all valves to dislodge any debris in valve body by throttling velocity. Flush for not less than one hour.

3.5 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. Adjust red set hand on pressure gauges to normal working pressure.

3.6 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

- - - E N D - - -

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Ductwork and accessories for HVAC including the following:

1. Supply air, return air, outside air, exhaust, make-up air, and relief systems.

C. Definitions:

1. 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.
2. Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
3. Exposed Duct: Exposed to view in a finished room.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 07 84 00, FIRESTOPPING.

E.

J. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

K. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

L. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

M. Section 23 07 11, HVAC and INSULATION.

N. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

O. Section 23 34 00, HVAC FANS.

T. Section 23 82 00, CONVECTION HEATING and COOLING UNITS.

U. Section 23 82 16, AIR COILS.

1.3 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.Where conflicts occur these specifications and the VHA standards will govern.

B. American Society of Civil Engineers (ASCE):

7-2016.....Minimum Design Loads for Associated Criteria for Buildings and Other Structures

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

A653/A653M-2020.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

A1011/A1011-2018a.....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

B209-2021.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C1071-2019.....Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)

E1-2014(R2020).....Standard Specification for ASTM Liquid-in-Glass Thermometers

E77-2014(R2021).....Standard Test Method for Inspection and Verification of Thermometers

E84-2021a.....Standard Test Method for Surface Burning Characteristics of Building Materials

D. National Fire Protection Association (NFPA):

90A-2021.....Standard for the Installation of Air-Conditioning and Ventilating Systems

96-2021.....Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

006–2020.....HVAC Duct Construction Standards, Metal and Flexible, 4th Edition

016-2012.....HVAC Air Duct Leakage Test Manual, 2nd Edition

2016.....Fibrous Glass Duct Construction Standards, 7th Edition

F. Underwriters Laboratories, Inc. (UL):

181-2013(R2017).....Standard for Factory-Made Air Ducts and Air Connectors

555-2006(R2020) .....Standard for Fire Dampers

555S-2014(R2020).....Standard for Smoke Dampers

G. Department of Veterans Affairs (VA):

PG-18-10-2015.....Physical Security Design Manual for VA Mission Critical Facilities

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Rectangular Ducts:
   a. Schedules of duct systems, materials and selected SMACNA construction alternatives for joints, sealing, gauge and reinforcement.
   b. Duct liner.
   c. Sealants and gaskets.
   d. Access doors.
2. Round and Flat Oval DuctS:
   a. Manufacturer's details for duct fittings.
   b. Sealants and gaskets.
   c. Access sections.
   d. 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.

D. Coordination Drawings: Refer to paragraph SUBMITTALS in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

B. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

C. Fire Safety Code: Comply with NFPA 90A.

D. Duct System Construction and Installation: Referenced SMACNA Standards are the minimum acceptable quality.

E. 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 in the contract documents.

F. 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 he duct or provide at least the same level of corrosion resistance.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

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/A653M, coating G90; or, aluminum sheet, ASTM B209, alloy 1100, 3003 or 5052.

B. Specified Corrosion Resistant Systems: Stainless-steel sheet, 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. Optional Duct Materials:

1. Grease Duct: Double wall factory-built grease duct, UL labeled and complying with NFPA 96 may be furnished in lieu of specified materials for kitchen and grill hood exhaust duct. Installation and accessories shall comply with the manufacturers catalog data. Outer jacket of exposed ductwork shall be stainless-steel. Square and rectangular duct shown in the contract documents will have to be converted to equivalent round size.

D. Joint Sealing: Refer to SMACNA HVAC Duct Construction Standards, Metal and Flexible.

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 prohibited 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.

E. 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:

1. 0 to 13 mm (0 to 1/2 inch)
2. 13 mm to 25 mm (1/2 inch to 1 inch)
3. 25 mm to 50 mm (1 inch to 2 inch)
4. 50 mm to 75 mm (2 inch to 3 inch)
5. 75 mm to 100 mm (3 inch to 4 inch)

C. Seal Class: All ductwork shall receive Class A Seal.

O. Casings and Plenums: Construct in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible, including curbs, access doors, pipe penetrations, eliminators and drain pans. Access doors shall be hollow metal, insulated, with latches and door pulls, 508 mm (20 inches) wide by 1219 to 1372 mm (48 to 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.

P. Volume Dampers: Single blade or opposed blade, multi-louver type as detailed in SMACNA Standards. Refer to SMACNA for Single Blade and Multi-blade Volume Dampers.

Q. Duct Hangers and Supports: Refer to SMACNA Standards. Avoid use of trapeze hangers for round duct.

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.
4. For cleaning operating room supply air duct and kitchen hood exhaust duct, locate access doors at 6.1 m (20 feet) intervals and at each change in duct direction.

B. Openings shall be as large as feasible in small ducts, 305 mm by 305 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, Metal and Flexible.
2. For Round and Flat Oval Ducts: Refer to SMACNA HVAC Duct Construction Standards, Metal and Flexible.

2.5 FIRE DAMPERS

A. Galvanized steel, interlocking blade type, UL listing and label, 1-1/2-hour rating, 70 degrees C (158 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 gauge), required to provide installation equivalent to the damper manufacturer's UL test installation.
2. Submit manufacturer's installation instructions conforming to UL rating test.

2.7 FIRE DOORS

A. 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.

2.8 FLEXIBLE AIR DUCT

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 greater than 203 mm (8 inches) in diameter

shall be Class 1. Ducts less than 203 mm (8 inches) in diameter shall be Class 1 or Class 2.

C. Insulated Flexible Air Duct: Factory-fabricated 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 152 mm (6 inch) duct, of 762 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: 1219 m/min (4000 fpm).
3. Minimum Working Pressure, Inches of Water Gauge: 2500 Pa (10 inches WG) positive, 500 Pa (2 inches WG) negative.

E. Duct Clamps: 100 percent nylon strap, 80 kg (176 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.

F. Flexible air duct is prohibited in operating room suites, SPS processing spaces, Pharmacy compounding spaces, Protective Environment spaces, Isolation Rooms, Clean Rooms, Bio-containment Laboratories, Research Laboratories, and Clinical Laboratories.

2.9 FLEXIBLE DUCT CONNECTIONS

A. Where duct connections are made to fans, air terminal units, and air handling units, install a non-combustible flexible connection of 822 g (29 ounces) neoprene coated fiberglass fabric approximately 152 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 ensure that no vibration is transmitted.

2.10

2.11 PREFABRICATED ROOF CURBS

A. Galvanized steel or extruded aluminum 305 mm (12 inches) above finish roof service, continuous welded corner seams, treated wood nailer, 38 mm (1-1/2 inch) thick, 48 kg/cubic meter (3 pound/cubic feet) density rigid mineral fiberboard insulation with metal liner, built-in cant strip (except for gypsum or tectum decks). For surface insulated roof deck, provide raised cant strip (recessed mounting flange) to start at the upper surface of the insulation. Curbs shall be constructed for pitched roof or ridge mounting as required to keep top of curb level.

2.12 FIRESTOPPING MATERIAL

A. Refer to Section 07 84 00, FIRESTOPPING.

2.14 DUCT MOUNTED THERMOMETER (AIR)

A. Stem Type Thermometers: ASTM E1, 7 inch scale, red appearing mercury, lens front tube, cast aluminum case with enamel finish and clear glass or polycarbonate window, brass stem, 2 percent of scale accuracy to ASTM E77 scale calibrated in degrees Fahrenheit.

B. Thermometer Supports:

1. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.
2. Flange: 75 mm (3 inch) outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC, particularly regarding coordination with other trades and work in existing buildings.

C. Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards:

1. Contract documents 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 in the contract documents 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. 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. Design casing access doors to swing against air pressure so that pressure helps to maintain a tight seal.

D. Install duct hangers and supports in accordance with SMACNA Standards.

E. Install fire dampers and smoke dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test. Install fire dampers and 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 resetting of fire dampers and operation of smoke dampers to the COR.

F. Seal openings around duct penetrations of floors and fire rated partitions with fire stop material as required by NFPA 90A.

G. Flexible Duct Installation: Refer to SMACNA Standards. Ducts shall be continuous, single pieces not over 1.5 m (5 feet) long per 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 hours. Support ducts SMACNA Standards.

H. 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.

I. 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.

J. Air Flow Measuring Devices: Install units with minimum straight run distances, upstream and downstream as recommended by the manufacturer.

K. Low Pressure Duct Liner: Install in accordance with SMACNA Standards.

L. 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 inches WG) duct pressure classification. In no case shall the leakage testing of ductwork constructed above the 500 Pa (2 inches 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 HVAC Air Duck 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.

3.4 TESTING, ADJUSTING, AND BALANCING (TAB)

A. Refer to Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

3.5 OPERATING AND PERFORMANCE TESTS

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

- - - E N D - - -

SECTION 23 34 00
HVAC FANS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Fans for heating, ventilating and air conditioning.

C. Product Definitions: AMCA 99.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G.Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC

H. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

I. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

K. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

M. Section 23 82 16, AIR COILS.

N. Section 26 29 11, MOTOR CONTROLLERS.

1.3 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. Where conflicts occur these specifications and the VHA standards will govern.

B. Air Movement and Control Association International, Inc. (AMCA):

99-2016.....Standards Handbook

210-2016.....Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

300-2014.....Reverberant Room Method for Sound Testing of Fans

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

B117-2019.....Standard Practice for Operating Salt Spray (Fog) Apparatus

D1735-2014.....Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus

D3359-2017.....Standard Test Methods for Rating Adhesion by Tape Test

G152-2013(R2021).....Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of NonMetallic Materials

G153-2013(R2021).....Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of NonMetallic Materials

D. National Fire Protection Association (NFPA):

NFPA 96-2021.....Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

E. National Sanitation Foundation (NSF):

37-2020 .....Air Curtains for Entranceways in Food and Food Service Establishments

F. Underwriters Laboratories, Inc. (UL):

181-2013.....Standard for Factory-Made Air Ducts and Air Connectors

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturers Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Plenum fan, motors, and drives.

5. Propeller fans.

D. Certified sound power levels for each fan.

E. Motor ratings, types, electrical characteristics, and accessories.

F. Certified fan performance curves for each fan showing cubic feet per minute (CFM) versus static pressure, efficiency, and horsepower for design point of operation.

G. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

A. Fans and power ventilators shall bear the AMCA performance seal.
B. Operating Limits for Centrifugal Fans: AMCA 99 (Class I, II, and III).
C. Fans and power ventilators shall comply with the following standards:
   1. Testing and Rating: AMCA 210.
   2. Sound Rating: AMCA 300.
D. Vibration Tolerance for Fans and Power Ventilators: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
E. Performance Criteria:
   1. The fan schedule shall show the design air volume and static pressure. Select the fan motor hp by increasing the fan bhp by 10 percent to account for the drive losses and field conditions.
   2. Select the fan operating point as follows:
      a. Forward Curve and Axial Flow Fans: Right hand side of peak pressure point.
      b. Air Foil, Backward Inclined, or Tubular: At or near the peak static efficiency.
F. Safety Criteria: Provide manufacturer's standard screen on fan inlet and discharge where exposed to operating and maintenance personnel.
G. Corrosion Protection:
   1. Except for fans in fume hood exhaust service, all steel shall be mill-galvanized, or phosphatized and coated with minimum two coats, corrosion resistant enamel paint. Manufacturer’s paint and paint system shall meet the minimum requirements of ASTM D1735 water fog, ASTM B117 salt spray, ASTM D3359 adhesion, and ASTM G152 and ASTM G153 for carbon arc light apparatus for exposure of non-metallic material.

2. Fans for general purpose fume hoods, or chemical hoods, and radioisotope hoods shall be constructed of materials compatible with the chemicals being transported in the air through the fan.

H. Spark resistant construction: If flammable gas, vapor or combustible dust is present in concentrations above 20 percent of the Lower Explosive Limit (LEL), the fan construction shall be as recommended by AMCA's Classification for Spark Resistant Construction.

I. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

J. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.4 POWER WALL VENTILATOR

A. Type: Centrifugal fan, backward inclined blades.

B. Construction: Steel or aluminum, completely weatherproof, for wall mounting, exhaust cowl or entire drive assembly readily removable for servicing, aluminum bird screen on discharge, UL approved safety disconnect switch, conduit for wiring, vibration isolators for wheel, motor and drive assembly. Provide self-acting back draft damper.

C. Motor and Drive: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Bearings shall be pillow block ball type with a minimum L-50 life

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Install fan, motor and drive in accordance with manufacturer's instructions.

D. Bolt equipment to curbs with galvanized lag bolts.

E. Install vibration control devices as shown in the contract documents and specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

3.2 PRE-OPERATION MAINTENANCE

A. Lubricate bearings and other moving parts with manufacturer recommended lubricants.

B. Rotate impeller by hand and check for shifting during shipment and check all bolts, collars, and other parts for tightness.

C. Clean fan interiors to remove foreign material and construction dirt and dust.

3.3 STARTUP AND TESTING

A. Verify operation of motor, drive system and fan wheel according to the contract documents.

B. Check vibration and correct as necessary for air balance work.

C. After air balancing is complete and permanent sheaves are in place perform necessary field mechanical balancing to meet vibration tolerance in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

D. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

E. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

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SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Air terminal units and air flow control valves.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

H. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

J. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

K. Section 23 21 13, HYDRONIC PIPING.

L. Section 23 31 00, HVAC DUCTS and CASINGS.

M. Section 23 34 00, HVAC FANS

1.3 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. Where conflicts occur these specifications and the VHA standards will govern.

B. Air Conditioning, Heating, and Refrigeration Institute (AHRI):
880-2017.....Performance Rating of Air Terminals

C. American Society for Testing and Materials (ASTM):
C665-2017.....Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

D. National Fire Protection Association (NFPA):
90A-2021.....Standard for the Installation of Air-Conditioning and Ventilating Systems

E. Underwriters Laboratories, Inc. (UL):
181-2013(R2017).....Standard for Factory-Made Air Ducts and Air Connectors

F. Department of Veterans Affairs (VA):
PG-18-10-2017(R2020)....HVAC Design Manual

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Air flow control valves.

D. Samples: Provide one typical air terminal unit for approval by the COR. This unit will be returned to the Contractor after all similar units have been shipped and deemed acceptable at the job site.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

A. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 GENERAL

A. Coils:

2. All Air Terminal Units: Provide aluminum fins and copper coils for all hot water reheat coils.
3. Water Heating Coils:

a. AHRI certified, continuous plate or spiral fin type, leak tested at 2070 kPa (300 psig).
b. Capacity: As indicated, based on scheduled entering water temperature.
c. Headers: Copper or Brass.
d. Fins: Aluminum, maximum 315 fins per meter (8 fins per inch).
e. Tubes: Copper, arrange for counter-flow of heating water.
f. Water Flow Rate: Minimum 0.032 Liters/second (0.5 gpm).
g. Water Flow Control Valve
h. Provide vent and drain connection at high and low point, respectively of each coil.
i. 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. Factory-calibrate air terminal units to air flow rate indicated. All settings including maximum and minimum air flow shall be field adjustable.

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.

F. Air terminal performance shall be in compliance with AHRI 880.

2.2 AIR TERMINAL UNITS (BOXES)

A. General: Factory-built, pressure independent units, factory set-field adjustable air flow rate, suitable for single duct applications. Use of dual-duct air terminal units is prohibited. Clearly show on each unit the unit number and factory set air volumes corresponding to the contract drawings. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC work assumes factory set air volumes. Coordinate flow controller sequence and damper operation details with the contract drawings and Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. 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) with the exception

of operating rooms and Cystoscopy rooms, which shall be served by a single air terminal unit at a maximum of 1,250 Liters/second (2,649 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 C665 antimicrobial requirements. Insulation shall consist of 13 mm (1/2 inch) 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. No lining material is permitted in the boxes serving operating rooms and Cystoscopy rooms.
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 inches WG), with all outlets sealed shut and inlets fully open.
4. Octopus Connector: Factory installed, lined air distribution terminal. Provide where flexible duct connections are shown on the contract drawings connected directly to terminals. Provide

butterfly-balancing damper, with locking means in connectors with more than one outlet. Octopus connectors and flexible connectors are prohibited in the Surgical Suite.

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 inches WG).

F. Provide multi-point velocity pressure sensors with external pressure taps. 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 factory mounting on air terminal units. The DDC controller shall be electrically actuated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Work shall be installed as shown and according to the manufacturer’s diagrams and recommendations.

C. Handle and install units in accordance with manufacturer's written instructions.

D. Support units rigidly so they always remain stationary. 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.

E. Locate air terminal units to provide a straight section of inlet duct for proper functioning of volume controls.

3.2 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards (for equipment acquired for this project and equipment substantially effected by this project) under actual or simulated operating conditions and prove full compliance with design intent and specified requirements. Tests of the various items of equipment shall

be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

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SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Air Outlets and Inlets: Diffusers, registers, and grilles.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 08 90 00, LOUVERS and VENTS.

G. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

H. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

I. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

1.3 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. Where conflicts occur these specifications and the VHA standards will govern.

B. Air Duct Council:
Flexible Duct Performance & Installation Standards (Manual), 5th Edition Green Book

C. American Society of Civil Engineers (ASCE):
7-2016.....Minimum Design Loads and Associated Criteria for Buildings and Other Structures

D. American Society for Testing and Materials (ASTM):
B209/B209M-2021.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

E. National Fire Protection Association (NFPA):
90A-2021.....Standard for the Installation of Air-Conditioning and Ventilating Systems

F. Underwriters Laboratories, Inc. (UL):
181-2013(R2017).....Standard for Factory-Made Air Ducts and Air Connectors

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Air intake/exhaust hoods.
   2. Diffusers, registers, grilles, and accessories.

D. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

A. Fire Safety Code: Comply with NFPA 90A.

B. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

C. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 2.3 AIR OUTLETS AND INLETS

A. Materials:
   1. Steel or aluminum. 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 Duct Council “Flexible Duct Performance & Installation Standards (Manual), Green Book”. Refer to Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT for NC criteria.

   5. Drum Louvers: Aluminum construction, drum louver, with pivoted blades and rotating drum to adjust length of throw and direction.
      a. Register shall have integral, face adjustable, opposed blade damper constructed of heavy gauge steel. Damper shall be operable from the face of the register. Units shall be nozzle type with adjustable discharge pattern.

2.5 FILTER RETURN/EXHAUST GRILLE

A. Provide grille within stream 25 mm (1 inch) deep MERV 4 filter and removable face.
   1. Finish: Off-white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting or shall be extruded aluminum with manufacturer's standard aluminum finish. Stainless-steel shall be No. 4 finish.
   2. Standard Type: Fixed horizontal face bars set at 30 to 45 degrees, approximately 32 mm (1-1/4 inch) margin.
   3. Steel, aluminum, or stainless-steel as scheduled.
   4. Standard face connected to a mounting frame with space for a throwaway filter. Hold face closed by a locking screw. Provide retaining clips to hold filter in place. Provide fiberglass throwaway filter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC, particularly regarding coordination with other trades and work in existing buildings.

C. 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.

3.3 TESTING, ADJUSTING, AND BALANCING (TAB)

A. Refer to Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

3.4 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

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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, conductors and cable 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 (National Electric Code). Aluminum conductors are prohibited.

1.2 MINIMUM REQUIREMENTS

A. The latest International Building Code (IBC), Underwriters Laboratories, Inc. (UL), Institute of Electrical and Electronics Engineers (IEEE), 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 shall be 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 (Contracting Officer Representative) 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 (Contracting Officer Representative) 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, freeze 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 (Contracting Officer Representative).
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 requirements of the latest NFPA 70 (NEC), NFPA 70B, NFPA 70E, NFPA 99, NFPA 110, NFPA 780, 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. However, energized electrical work may be performed only for the non-destructive and non-invasive diagnostic testing(s), or when scheduled outage poses an imminent hazard to patient care, safety, or physical security. In such case, all aspects of energized electrical work, such as the availability of appropriate/correct personal protective equipment (PPE) and the use of PPE, shall comply with the latest NFPA 70E, as well as the following requirements:

1. Only Qualified Person(s) shall perform energized electrical work. Supervisor of Qualified Person(s) shall witness the work of its entirety to ensure compliance with safety requirements and approved work plan.
2. At least two weeks before initiating any energized electrical work, the Contractor and the Qualified Person(s) who is designated to perform the work shall visually inspect, verify, and confirm that the work area and electrical equipment can safely accommodate the work involved.
3. At least two weeks before initiating any energized electrical work, the Contractor shall develop and submit a job specific work plan, and energized electrical work request to the COR (Contracting Officer Representative) and Medical Center’s Chief Engineer or his/her designee. At the minimum, the work plan must include relevant information such as proposed work schedule, area of work, description of work, name(s) of Supervisor and Qualified Person(s) performing the work, equipment to be used, procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used, and exit pathways.
4. Energized electrical work shall begin only after the Contractor has obtained written approval of the work plan, and the energized electrical work request from the COR (Contracting Officer Representative) and Medical Center’s Chief Engineer or his/her designee. The Contractor shall make these approved documents present and available at the time and place of energized electrical work.

5. Energized electrical work shall begin only after the Contractor has invited and received acknowledgment from the COR (Contracting Officer Representative) and Medical Center’s Chief Engineer or his/her designee to witness the work.

D. For work that affects existing electrical systems, arrange, phase, and perform work to assure minimal interference with normal functioning of the facility. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

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, as required by Section 01 00 00, GENERAL REQUIREMENTS.

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 spaces or working clearances shall comply with NEC’s requirements, at a minimum.

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.

D. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company’s system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company’s system and obtain electric utility company approval for sizes and settings of these devices.

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, generators, automatic transfer 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 white phenolic resin with a black 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 (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 the latest 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. Equipment/bus name, date prepared, and manufacturer name and address.
3. Arc flash boundary.
4. Available arc flash incident energy and the corresponding working distance.
5. Minimum arc rating of clothing.
6. Site-specific level of PPE.

1.12 SUBMITTALS

A. Submit to the COR (Contracting Officer Representative) 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.

3. 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.
4. 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 (Contracting Officer Representative) / with one sample of each of the following:
1. A minimum (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 manufacturers’ 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 for the equipment. Repair, replacement, and re-testing 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 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 and factory-trained 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 factory-trained in operating theory as well as practical operation and maintenance procedures.

C. A training schedule shall be developed and submitted by the Contractor and approved by the COR (Contracting Officer Representative) at least 30 days prior to the planned training.

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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 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-resistant rated construction.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

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 fault currents.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for conductors and cables.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

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.

1.5 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 designation only.

B. American Society of Testing Material (ASTM):

D2301-10.....Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

D2304-18.....Test Method for Thermal Endurance of Rigid Electrical Insulating Materials

D3005-17.....Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

C. National Electrical Manufacturers Association (NEMA):

WC 70-21.....Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

D. National Fire Protection Association (NFPA):

70-23.....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):

44-18.....Thermoset-Insulated Wires and Cables

83-17.....Thermoplastic-Insulated Wires and Cables

467-13.....Grounding and Bonding Equipment

486A-486B-18.....Wire Connectors

486C-18.....Splicing Wire Connectors

486D-15.....Sealed Wire Connector Systems

486E-15.....Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

493-18.....Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables

514B-12.....Conduit, Tubing, and Cable Fittings

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Conductors and cables shall be in accordance with ASTM, NEMA, NFPA, UL, as specified herein, and as shown on the drawings.

B. Conductors shall be copper.

C. Single Conductor:

1. No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.
2. No. 12 AWG and larger: Stranded.
3. No. 14 AWG and smaller: Solid; except shall be stranded for final connection to motors, transformers, and vibrating equipment.
4. Insulation: THHN-THWN.

D. Conductor 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.
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 (Contracting Officer Representative).
7. Color code for isolated power system wiring shall be in accordance with the NEC.

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 plated steel.

D. 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, or as required by the control wiring equipment manufacturer.

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.

B. Shall not be used on conductors for isolated power systems.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer's instructions.

B. Install conductors in raceway systems.

C. Conductors of different systems (e.g., 120 V and 277 V) shall not be installed in the same raceway.

D. For conductors installed in vertical raceways, provide conductor support (also known as cable support), to counter gravity pull on conductor weight. Conductor support shall be split-wedge conductor support type. Prior to installing the conductor support plug, remove all pulling compound from conductors where they pass through the conductor support body. After installing the conductor support plug, tap the conductor support plug firmly in the conductor support body.

E. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic "zip" ties.

F. 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.

G. Use expanding foam or non-hardening duct-seal to seal conduits entering a building, after installation of conductors.

H. Conductor 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 manufacturers' recommended maximum pulling tensions and sidewall pressure values.

I. Number of conductors for branch circuits shall not exceed more than three branch circuits in any one conduit.

J. 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 manufacturers' 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 (3 inches) from terminal points, and in junction boxes and pull-boxes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where markings are covered by tape, apply tags to conductors, stating size and insulation type.

3.4 FEEDER CONDUCTOR IDENTIFICATION

A. In each interior pull-box install brass tags on all feeder conductors to clearly designate their circuit identification and voltage. The tags shall be the embossed type, (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. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

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 (Contracting Officer Representative).

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):
   B1-13.....Standard Specification for Hard-Drawn Copper Wire
   B3-13(R2018).....Standard Specification for Soft or Annealed Copper Wire
   B8-11(R2017).....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   81-12.....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):
   70-23.....National Electrical Code (NEC)
   70E-21.....National Electrical Safety Code
   99-21.....Health Care Facilities

E. Underwriters Laboratories, Inc. (UL):
   44-18 .....Thermoset-Insulated Wires and Cables
   83-17 .....Thermoplastic-Insulated Wires and Cables
   467-13 .....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. XHHW-2 shall be used for isolated power systems.

2.2 GROUND CONNECTIONS

AB. Above Grade:

1. Bonding Jumpers: Listed for use with aluminum and copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
2. Connection to Building Steel: Exothermic-welded type connectors.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer’s instructions.

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 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 an equipment grounding conductor to the equipment ground bus.

B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and all branch circuits.

C. Boxes, Cabinets, Enclosures, and Panelboards:

1. Bond the equipment grounding conductor to each pull box, 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 every (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 (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.

3.3 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.

3.4 ACCEPTANCE CHECKS AND TESTS

A. 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 or connected to the electric utility company ground system and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall.

B. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

---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

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

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 Iron and Steel Institute (AISI):

S100-16.....North American Specification for the Design of Cold-Formed Steel Structural Members

C. National Electrical Manufacturers Association (NEMA):

C80.1-20.....Electrical Rigid Steel Conduit

C80.3-20.....Steel Electrical Metal Tubing

C80.6-18.....Electrical Intermediate Metal Conduit

FB1-14.....Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

FB2.10-21.....Selection and Installation Guidelines for Fittings for use with Non-Flexible Conduit or Tubing (Rigid Metal Conduit, Intermediate Metallic Conduit, and Electrical Metallic Tubing)

FB2.20-21.....Selection and Installation Guidelines for Fittings for use with Flexible Electrical Conduit and Cable

TC-2-20.....Electrical Polyvinyl Chloride (PVC) Tubing and Conduit

TC-3-21.....PVC Fittings for Use with Rigid PVC Conduit and Tubing

D. National Fire Protection Association (NFPA):

70-23.....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):

1-05.....Flexible Metal Conduit

5-16.....Surface Metal Raceway and Fittings

6-07.....Electrical Rigid Metal Conduit - Steel

50-15.....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-14.....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

PART 2 - PRODUCTS

2.1 MATERIAL

A. Conduit Size: In accordance with the NEC, but not less than (0.75-inch) unless otherwise shown. Where permitted by the NEC, (0.75-inch) 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 (0.75-inch).
2. Electrical Metallic Tubing (EMT): Shall conform to UL 797 and NEMA C80.3. Maximum size not to exceed (4 inches) and shall be permitted only with cable rated 600 V or less.
2. Flexible Metal Conduit: Shall conform to UL 1.

C. Conduit Fittings:

1. Electrical Metallic Tubing Fittings:
   a. Fittings and conduit bodies shall meet the requirements of UL 514B, NEMA C80.3, and NEMA FB1.
   b. Only steel or malleable iron materials are acceptable.
   c. Set Screw Fittings: 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.

2. Flexible Metal Conduit Fittings:
   a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
   b. Clamp-type, with insulated throat.
3. Expansion and Deflection Couplings:
   a. Conform to UL 467 and UL 514B.
   b. Accommodate a (0.75-inch) 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 inches), 12-gauge steel, cold-formed, lipped channels; with not less than (0.375-inch) 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. Comply with 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 shown on drawings.

F. Metal Wireways: Equip with hinged covers, except as shown on drawings. 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 (Contracting Officer Representative) 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 when permitted by the COR (Contracting Officer Representative) where working space is limited.

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 as specified in Section 07 84 00, FIRESTOPPING.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal the gap around conduit to render it watertight, as specified in Section 07 92 00, JOINT SEALANTS.

3.2 INSTALLATION, GENERAL

A. In accordance with NEC, NEMA, UL, 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 (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 (12 inches) of changes of direction, and within (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.
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. 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.

E. 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 and approved by the //Resident Engineer// //COR//.

3.3 CONCEALED WORK INSTALLATION

A. Above Furred or Suspended Ceilings and in Walls:

1. Conduit for Conductors Below 600 V: EMT (Electrical Metallic Tubing). Mixing different types of conduits in the same system is prohibited.
2. Align and run conduit parallel or perpendicular to the building lines.

3. 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.
4. Tightening set screws with pliers is prohibited.
5. 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 (18 inches). Cuts or notches in flanges or return lips shall not be permitted.

3.4 EXPOSED WORK INSTALLATION

A. Unless otherwise indicated on drawings, exposed conduit is only permitted in mechanical and electrical rooms.

B. Conduit for Conductors 600 V and Below: EMT (Electrical Metallic Tubing). Mixing different types of conduits 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 feet) intervals.

H. Painting:

1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
2. Paint all conduits containing cables rated over 600 V safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using (2 inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum (20 feet) intervals in between.

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. Conduits run on roof shall be supported with integral galvanized lipped steel channel, attached to UV-inhibited polycarbonate or polypropylene blocks every (8 feet) with (3/8-inch) galvanized threaded rods, square washer, and locknut. Conduits shall be attached to steel channel with conduit clamps.

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.

C. Provide a green equipment grounding conductor with flexible and liquid-tight flexible metal conduit.

3.7 EXPANSION JOINTS

A. Conduits (3 inch) 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 (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 (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

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 an additional (200 lbs.). 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-inch) bolt size and not less than (1.125 inch) in embedment.
   b. Power set fasteners not less than (0.25-inch) diameter with depth of penetration not less than (3 inch).
   c. Use vibration and shock-resistant anchors and fasteners for attaching 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 pull-boxes 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 (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 (4 inches) square x (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, "ELECTRICAL PB No. 1."

I. On all branch circuit junction box covers, identify the circuits with black marker.

- - - E N D - - -

SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of low-voltage dry-type general-purpose transformers, indicated as transformers 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.

BC Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

D. 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.

E. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

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, temperature rise, wiring and connection diagrams, plan, front, side, and rear elevations, accessories, and device nameplate data.
2. Manuals:
   a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets and wiring diagrams.

1) Schematic signal and control diagrams, with all terminals identified, matching terminal identification in the transformers.
2) Include information for testing, repair, troubleshooting, assembly, disassembly, and factory recommended/required periodic maintenance procedures and frequency.

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 transformers conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the transformers 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-21.....International Building Code

C. National Fire Protection Association (NFPA):
70-23.....National Electrical Code (NEC)

D. National Electrical Manufacturers Association (NEMA):
TR 1-19.....Transformers, Step Voltage Regulators and Reactors
ST 20-14.....Dry Type Transformers for General Applications

E. Underwriters Laboratories, Inc. (UL):
UL 506-17.....Standard for Safety - Specialty Transformers
UL 1561-11.....Standard for Safety - Dry-Type General Purpose and Power Transformers

F. United States Department of Energy:
10 CFR Part 431.....Energy Efficiency Program for Certain

PART 2 - PRODUCTS

2.1 TRANSFORMERS

A. Unless otherwise specified, transformers shall be in accordance with NEMA, NFPA, UL and as shown on the drawings.

B. Transformers shall have the following features:

1. Self-cooled by natural convection, isolating windings, indoor dry type. Auto transformers will not be accepted, except as specifically allowed for buck-boost applications.
2. Rating and winding connections shall be as shown on the drawings.
3. Ratings shown on the drawings are for continuous duty without the use of cooling fans.
4. Copper windings.
5. Insulation systems:
   a. Transformers 30 kVA and larger: UL rated 220 °C (428 °F) system with an average maximum rise by resistance of 150 °C (302 °F) in a maximum ambient of 40 °C (104 °F).
6. Core and coil assemblies:
   a. Rigidly braced to withstand the stresses caused by short-circuit currents and rough handling during shipment.
   b. Cores shall be grain-oriented, non-aging, and silicon steel.
   c. Coils shall be continuous windings without splices except for taps.
   d. Coil loss and core loss shall be minimized for efficient operation.
   e. Primary and secondary tap connections shall be brazed or pressure type.
   f. Coil windings shall have end filters or tie-downs for maximum strength.
7. Average audible sound levels shall comply with NEMA.
8. If not shown on drawings, nominal impedance shall be as permitted by NEMA.
9. Core assemblies shall be grounded to their enclosures with adequate flexible ground straps.
10. Enclosures:
    a. Comprised of not less than code gauge steel.

b. Temperature rise at hottest spot shall conform to NEMA Standards and shall not bake and peel off the enclosure paint after the transformer has been placed in service.

c. Ventilation openings shall prevent accidental access to live components.

d. The enclosure at the factory shall be thoroughly cleaned and painted with manufacturer's prime coat and standard finish.

11. Standard NEMA features and accessories, including ground pad, lifting provisions, and nameplate with the wiring diagram and sound level indicated.

12. Dimensions and configurations shall conform to the spaces designated for their installations.

13. Transformers shall meet the energy conservation standards for transformers per the United States Department of Energy’s 10 CFR Part 431.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of transformers shall be in accordance with the NEC, as recommended by the equipment manufacturer and as shown on the drawings.

B. Anchor transformers with rustproof bolts, nuts, and washers, in accordance with manufacturer’s instructions, and as shown on drawings.

C. Install transformers with manufacturers’ recommended clearance from wall and adjacent equipment for air circulation. Minimum clearance shall be (6 inches).

D. Install transformers on vibration pads designed to suppress transformer noise and vibrations.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform tests 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 and mechanical condition.

c. Inspect all field-installed bolted electrical connections, using the calibrated torque-wrench method to verify tightness of accessible bolted electrical connections.

d. Perform specific inspections and mechanical tests as recommended by manufacturer.

e. Verify correct equipment grounding.

f. Verify proper secondary phase-to-phase and phase-to-neutral voltage after energization and prior to connection to loads.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the transformers are in good operating condition and properly performing the intended function.

---END---

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. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

D. 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.

E. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

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-21.....International Building Code

C. National Electrical Manufacturers Association (NEMA):
PB 1-11.....Panelboards
250-20.....Enclosures for Electrical Equipment (1,000V Maximum)

D. National Fire Protection Association (NFPA):
70-23.....National Electrical Code (NEC)
70E-21.....Standard for Electrical Safety in the Workplace

E. Underwriters Laboratories, Inc. (UL):
50-15.....Enclosures for Electrical Equipment
67-09.....Panelboards
489-16.....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 sub-feed 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 end walls.
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.
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.

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.
D. Install a printed schedule of circuits in each panelboard after approval by the COR (Contracting Officer Representative) . 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 (78 inches).
F. Provide blank cover for each unused circuit breaker mounting space. 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 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Cables and wiring.

C. 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.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

E. Section 26 51 00, INTERIOR LIGHTING: LED drivers for use with manual dimming controls.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

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 Electrical Manufacturers Association (NEMA):

WD 1-99(R2020).....General Color Requirements for Wiring Devices

WD 6-16 .....Wiring Devices – Dimensional Specifications

C. National Fire Protection Association (NFPA):

70-23.....National Electrical Code (NEC)

99-21.....Health Care Facilities

D. Underwriter’s Laboratories, Inc. (UL):

5-16.....Surface Metal Raceways and Fittings

20-18.....General-Use Snap Switches

231-16.....Power Outlets

467-13.....Grounding and Bonding Equipment

498-17.....Attachment Plugs and Receptacles

943-16.....Ground-Fault Circuit-Interrupters

1449-21.....Surge Protective Devices

1472-15.....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 nickel plated brass, brass, nickel plated steel or galvanize 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: shall be listed for 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 ivory in color.
2. Duplex Receptacles on Emergency Circuit:
   a. In rooms without emergency powered general lighting, the emergency receptacles shall be of the self-illuminated type.
3. Ground Fault Current Interrupter (GFCI) 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. GFCI receptacles shall be self-test receptacles in accordance with UL 943.
   a. Ground fault interrupter shall consist of a differential current transformer, self-test, 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.
   b. Self-test function shall be automatically initiated within 5 seconds after power is activated to the receptacles. Self-test function shall be periodically and automatically performed every 3 hours or less.
   c. End-of-life indicator light shall be a persistent flashing or blinking light to indicate that the GFCI receptacle is no longer in service.

C. Duplex Receptacles – Non-hospital Grade: shall be the same as duplex receptacles – hospital grade in accordance with sections 2.1A and 2.1B of this specification, except for the hospital grade listing.

1. Bodies shall be brown nylon.

D. Receptacles - 20, 30, and 50 ampere, 250 Volts: Shall be complete with appropriate cord grip plug.

2.2 TOGGLE SWITCHES

A. Toggle switches shall be totally enclosed tumbler type with nylon bodies. Handles shall be ivory in color unless otherwise specified or shown on the drawings.
   1. Switches installed in hazardous areas shall be explosion-proof type in accordance with the NEC and as shown on the drawings.
   2. 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.
   3. 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.

B. Color shall be ivory unless otherwise specified.

C. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.

D. In areas requiring tamperproof wiring devices, wall plates shall be type 302 stainless steel and shall have tamperproof screws and beveled edges.

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 connected to the branch circuit equipment grounding conductor.

D. Outlet boxes for toggle switches and manual dimming controls shall be mounted on the strike side of doors.

E. Provide barriers in multi-gang 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. Pay special

attention to installations in cabinet work, and in connection with laboratory equipment.

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 (48 inches) above floor, with the toggle OFF position down.

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I. When required or recommended by the manufacturer, use a torque screwdriver. Tighten unused terminal screws.

J. 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, and the latest NFPA 99. In addition, include the following:

1. Visual Inspection and Tests:
   a. Inspect physical and electrical conditions.
   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 11
MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of motor controllers, including all low- and medium-voltage motor controllers and manual motor controllers, indicated as motor controllers in this section, and low-voltage variable speed motor controllers.

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.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Include electrical ratings, dimensions, weights, mounting details, materials, overcurrent protection devices, overload relays, sizes of enclosures, wiring diagrams, starting characteristics, interlocking, and accessories.
2. Manuals:
   a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.

1) Wiring diagrams shall have their terminals identified to facilitate installation, maintenance, and operation.
2) Wiring diagrams shall indicate internal wiring for each item of equipment and interconnections between the items of equipment.
3) Elementary schematic diagrams shall be provided for clarity of operation.
4) Include the catalog numbers for the correct sizes of overload relays for the motor controllers.

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 motor controllers conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the motor controllers 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 basic designation only.

B. Institute of Electrical and Electronic Engineers (IEEE):
519-14.....Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
C37.90.1-12.....Standard Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus

C. International Code Council (ICC):
IBC-21.....International Building Code

D. National Electrical Manufacturers Association (NEMA):
ICS 1-00(R2015).....Industrial Control and Systems: General Requirements
ICS 1.1-84(R2020).....Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control

ICS 2-00(R2020).....Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 Volts

ICS 4-15.....Industrial Control and Systems: Terminal Blocks

ICS 6-93(R2016).....Industrial Control and Systems: Enclosures

ICS 7-20.....Industrial Control and Systems: Adjustable-Speed Drives

ICS 7.1-14.....Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems

E. National Fire Protection Association (NFPA):

70-23.....National Electrical Code (NEC)

F. Underwriters Laboratories Inc. (UL):

508A-18.....Industrial Control Panels

1449-14.....Surge Protective Devices

61800-5-1-12.....Adjustable Speed Electrical Power Drive Systems

PART 2 - PRODUCTS

2.1 MOTOR CONTROLLERS

A. Motor controllers shall comply with IEEE, NEMA, NFPA, UL, and as shown on the drawings.

B. Motor controllers shall be separately enclosed, unless part of another assembly. For installation in motor control centers, provide plug-in, draw-out type motor controllers up through NEMA size 4. NEMA size 5 and above require bolted connections.

C. Motor controllers shall be combination type, with magnetic controller per Paragraph 2.3 below and with circuit breaker disconnecting means, with external operating handle with lock-open padlocking positions and ON-OFF position indicator.

1. Circuit Breakers:

   a. Bolt-on thermal-magnetic type with a minimum interrupting rating as indicated on the drawings.

   b. Equipped with automatic, trip free, non-adjustable, inverse-time, and instantaneous magnetic trips for less than 400A. The magnetic trip shall be adjustable from 5x to 10x for breakers 400A and greater.

   c. Additional 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, a common trip bar for all poles, and one operator for all poles.

D. Enclosures:
1. Enclosures shall be NEMA-type rated 1, 3R, or 12 as indicated on the drawings or as required per the installed environment.
2. Enclosure doors shall be interlocked to prevent opening unless the disconnecting means is open. A "defeater" mechanism shall allow for inspection by qualified personnel with the disconnect means closed. Provide padlocking provisions.
3. All metal surfaces shall be thoroughly cleaned, phosphatized, and factory primed prior to applying light gray baked enamel finish.

E. Motor control circuits:
1. Shall operate at not more than 120 Volts.
2. Shall be grounded, except where the equipment manufacturer recommends that the control circuits be isolated.
3. For each motor operating over 120 Volts, incorporate a separate, heavy duty control transformer within each motor controller enclosure.
4. Incorporate primary and secondary overcurrent protection for the control power transformers.

F. Overload relays:
1. Thermal Relay. Devices shall be NEMA type.
2. One for each pole.
3. External overload relay reset pushbutton on the door of each motor controller enclosure.
4. Overload relays shall be matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
5. Thermal overload relays shall be tamperproof, not affected by vibration, manual reset, sensitive to single-phasing, and shall have selectable trip classes of 10, 20 and 30.

G. Hand-Off-Automatic (H-O-A) switch is required unless specifically stated on the drawings as not required for a particular controller. H-O-A switch shall be operable without opening enclosure door. H-O-A switch is not required for manual motor controllers.

H. Incorporate into each control circuit a 120 Volt, electronic time-delay relay (ON delay), minimum adjustable range from 0.3 to 10 minutes, with transient protection. Time-delay relay is not required where H-O-A switch is not required.

I. Unless noted otherwise, equip each motor controller with not less than two normally open (N.O.) and two normally closed (N.C.) auxiliary contacts.

J. Provide green (RUN) and red (STOP) pilot lights.

K. Motor controllers incorporated within equipment assemblies shall also be designed for the specific requirements of the assemblies.

L. Additional requirements for specific motor controllers, as indicated in other specification sections, shall also apply.

2.2 MANUAL MOTOR CONTROLLERS

A. Shall be in accordance with applicable requirements of 2.1 above.

B. Manual motor controllers shall have the following features:

1. Controllers shall be general-purpose Class A, manually operated type with full voltage controller for induction motors, rated in horsepower.
2. Units shall include thermal overload relays, on-off operator, green// pilot light, normally open auxiliary contacts.

C. Fractional horsepower manual motor controllers shall have the following features:

1. Controllers shall be general-purpose Class A, manually operated type with full voltage controller for fractional horsepower induction motors.
2. Units shall include thermal overload relays, red pilot light, and toggle operator.

2.3 MAGNETIC MOTOR CONTROLLERS

A. Shall be in accordance with applicable requirements of 2.1 above.

B. Controllers shall be general-purpose, Class A magnetic controllers for induction motors rated in horsepower. Minimum NEMA size 0.

C. Where combination motor controllers are used, combine controller with protective or disconnect device in a common enclosure.

D. Provide phase loss protection for each controller, with contacts to de-energize the controller upon loss of any phase.

E. Unless otherwise indicated, provide full voltage non-reversing across-the-line mechanisms for motors less than 75 HP, closed by coil action and

opened by gravity. For motors 75 HP and larger, provide reduced-voltage or variable speed controllers as shown on the drawings. Equip controllers with 120 VAC coils and individual control transformer unless otherwise noted.

2.6 LOW-VOLTAGE VARIABLE SPEED MOTOR CONTROLLERS (VSMC)

A. VSMC shall be in accordance with applicable portions of 2.1 above.

B. VSMC shall be electronic, with adjustable frequency and voltage, three phase output, capable of driving standard NEMA B three-phase induction motors at full rated speed. The control technique shall be pulse width modulation (PWM), where the VSMC utilizes a full wave bridge design incorporating diode rectifier circuitry. Silicon controlled rectifiers or other control techniques are not acceptable.

C. VSMC shall be suitable for variable torque loads and shall be capable of providing sufficient torque to allow the motor to break away from rest upon first application of power.

D. VSMC shall be capable of operating within voltage parameters of plus 10 to minus 15 percent of line voltage and be suitably rated for the full load amps of the maximum watts (HP) within its class.

E. Minimum efficiency shall be 95 percent at 100 percent speed and 85 percent at 50 percent speed.

F. The displacement power factor of the VSMC shall not be less than 95 percent under any speed or load condition.

G. VSMC current and voltage harmonic distortion shall not exceed the values allowed by IEEE 519.

H. Operating and Design Conditions:

1. Elevation: feet Above Mean Sea Level (AMSL)
2. Relative Humidity: 95%
3. VSMC Location: Air-conditioned space

I. VSMC shall have the following features:

1. Isolated power for control circuits.
2. Manually resettable overload protection for each phase.
3. Adjustable current limiting circuitry to provide soft motor starting. Maximum starting current shall not exceed 200 percent of motor full load current.
4. Independent acceleration and deceleration time adjustment, manually adjustable from 2 to 2000 seconds. Set timers to the equipment manufacturer's recommended time in the above range.

5. Control input circuitry that will accept 4 to 20 mA current or 0-10 VDC voltage control signals from an external source.
6. Automatic frequency adjustment from 1 Hz to 300 Hz.
7. Circuitry to initiate an orderly shutdown when any of the conditions listed below occur. The VSMC shall not be damaged by any of these electrical disturbances and shall automatically restart when the conditions are corrected. The VSMC shall be able to restart into a rotating motor operating in either the forward or reverse direction and matching that frequency.
   a. Incorrect phase sequence.
   b. Single phasing.
   c. Overvoltage in excess of 10 percent.
   d. Undervoltage in excess of 15 percent.
   e. Running overcurrent above 110 percent (VSMC shall not automatically reset for this condition.)
   f. Instantaneous overcurrent above 150 percent (VSMC shall not automatically reset for this condition).
   g. short duration power outages of 12 cycles or less (i.e., distribution line switching, generator testing, and automatic transfer switch operations.)
8. Automatic Reset/Restart: Attempt three restarts after VSMC fault or on return of power after an interruption and before shutting down for manual reset or fault correction, with adjustable delay time between restart attempts.
9. Bidirectional Autopsied Search: Capable of starting VSMC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to VSMC, motor, or load.

J. VSMC shall include an input circuit breaker which will disconnect all input power, interlocked with the door so that the door cannot be opened with the circuit breaker in the closed position.

K. VSMC shall include a 5%-line reactor and an RFI/EMI filter.

L. Surge Suppression: Provide three-phase protection against damage from supply voltage surges in accordance with UL 1449.

M. VSMC shall include front-accessible operator station, with sealed keypad and digital display, which allows complete programming, operating, monitoring, and diagnostic capabilities.

1. Typical control functions shall include but not be limited to:
   a. HAND-OFF-AUTOMATIC-RESET, with manual speed control in HAND mode.
   b. NORMAL-BYPASS.
   c. NORMAL-TEST, which allows testing and adjusting of the VSMC while in bypass mode.
2. Typical monitoring functions shall include but not be limited to:
   a. Output frequency (Hz).
   b. Motor speed and status (run, stop, fault).
   c. Output voltage and current.
3. Typical fault and alarm functions shall include but not be limited to:
   a. Loss of input signal, under- and over-voltage, inverter overcurrent, motor overload, critical frequency rejection with selectable and adjustable deadbands, instantaneous line-to-line and line-to-ground overcurrent, loss-of-phase, reverse-phase, and short circuit.
   b. System protection indicators indicating that the system has shut down and will not automatically restart.

N. VSMC shall include two N.O. and two N.C. dry contacts rated at 120 Volts, 10 amperes, 60 Hz.

O. Hardware, software, network interfaces, gateways, and programming to control and monitor the VSMC by control systems specified in other specification sections, including but not limited to Divisions 22 and 23.

P. Network communications ports: As required for connectivity to control systems specified in other specification sections, including but not limited to Divisions 22 and 23.

Q. Communications protocols: As required for communications with control systems specified in other specification sections, including but not limited to Divisions 22 and 23.

R. Bypass controller: Provide contactor-style bypass, arranged to bypass the inverter.
   1. Inverter Output Contactor and Bypass Contactor: Load-break NEMA-rated contactor.
   2. Motor overload relays.
   3. HAND-OFF-AUTOMATIC bypass control.

S. Bypass operation: Transfers motor between inverter output and bypass circuit, manually, automatically, or both. VSMC shall be capable of stable operation (starting, stopping, and running), and control by fire alarm and detection systems, with motor completely disconnected from the inverter output. Transfer between inverter and bypass contactor and retransfer shall only be allowed with the motor at zero speed.

T. Inverter Isolating Switch: Provide non-load-break switch arranged to isolate inverter and permit safe troubleshooting and testing of the inverter, both energized and de-energized, while motor is operating in bypass mode. Include pad lockable, door-mounted handle mechanism.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motor controllers in accordance with the NEC, as shown on the drawings, and as recommended by the manufacturer.

C. Install manual motor controllers in flush enclosures in finished areas.

D. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and electronic overload relay pickup and trip ranges.

E. Program variable speed motor controllers per the manufacturer’s instructions and in coordination with other trades so that a complete and functional system is delivered.

F. Adjust trip settings of circuit breakers and motor circuit protectors with adjustable instantaneous trip elements. Initially adjust at six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficiency motors if required). Where these maximum settings do not allow starting of a motor, notify COR (Contracting Officer Representative) before increasing settings.

G. Set the taps on reduced-voltage autotransformer controllers at 50 percent of line voltage.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform manufacturer’s required field tests 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, required area clearances, and correct alignment.
d. Verify that circuit breaker, motor circuit protector, and fuse sizes and types correspond to approved shop drawings.
e. Verify overload relay ratings are correct.
f. Vacuum-clean enclosure interior. Clean enclosure exterior.
g. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer’s published data.
h. Test all control and safety features of the motor controllers.
i. For low-voltage variable speed motor controllers, final programming and connections shall be by a factory-trained technician. Set all programmable functions of the variable speed motor controllers to meet the requirements and conditions of use.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the motor controllers are in good operating condition and properly performing the intended functions.

3.4 SPARE PARTS

A. Two weeks prior to the final inspection, provide one complete set of spare fuses for each motor controller.

3.5 INSTRUCTION

A. Furnish the services of a factory-trained technician for two 4-hour training periods for instructing personnel in the maintenance and operation of the motor controllers, on the dates requested by the COR (Contracting Officer Representative).

---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. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

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-21.....International Building Code

C. National Electrical Manufacturers Association (NEMA):
FU l-12.....Low Voltage Cartridge Fuses
KS l-13.....Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum)

D. National Fire Protection Association (NFPA):
70-23.....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):
98-16.....Enclosed and Dead-Front Switches
248 1-11.....Low Voltage Fuses
489-16.....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 General Duty (GD) for 240 V switches, and NEMA classified Heavy Duty (HD) for 480 V switches.

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 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.

2.4 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 NEC, as shown on the drawings, and manufacturer’s instructions.

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 (Contracting Officer Representative) .

---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 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

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.

E. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

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.

g. Photometric data based on laboratory tests complying with IES Lighting Measurements testing and calculation guides.

h. Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours), and color temperature (degrees Kelvin).

i. For LED lighting fixtures, submit US DOE LED Lighting Facts label, and IES L70 rated life.

2. Manuals:

a. Submit, simultaneously with the shop drawings, complete maintenance, and operating manuals, including technical data sheets, wiring diagrams, 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 Contractor that the interior lighting systems have 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):
C635/C635M-22.....Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

C. Environmental Protection Agency (EPA):
40 CFR 261-21.....Identification and Listing of Hazardous Waste

D. Federal Communications Commission (FCC):
CFR Title 47, Part 15...Radio Frequency Devices
CFR Title 47, Part 18...Industrial, Scientific, and Medical Equipment

E. Illuminating Engineering Society of North America (IESNA):
LM-79-19.....Electrical and Photometric Measurements of Solid-State Lighting Products

LM-80-21.....Measuring Lumen Maintenance of LED Light Sources

LM-82-19.....Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature

F. Institute of Electrical and Electronic Engineers (IEEE):

C62.41-91(R1995).....Surge Voltages in Low Voltage AC Power Circuits

G. International Code Council (ICC):

IBC-21.....International Building Code

H. National Electrical Manufacturer's Association (NEMA):

C78.376-14 (R2021).....Chromaticity of Fluorescent Lamps

C82.1-04(S2021).....Lamp Ballasts – Line Frequency Fluorescent Lamp Ballasts

C82.2-02(S2021).....Method of Measurement of Fluorescent Lamp Ballasts

C82.4-17.....Lamp Ballasts - Ballasts for High-Intensity Discharge and Low-Pressure Sodium (LPS) Lamps (Multiple-Supply Type)

C82.11-17.....Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts

LL 9-11.....Dimming of T8 Fluorescent Lighting Systems

SSL 1-16.....Electronic Drivers for LED Devices, Arrays, or Systems

I. National Fire Protection Association (NFPA):

70-23.....National Electrical Code (NEC)

101-21.....Life Safety Code

J. Underwriters Laboratories, Inc. (UL):

496-17.....Lampholders

542-05.....Fluorescent Lamp Starters

844-12.....Luminaires for Use in Hazardous (Classified) Locations

924-16.....Emergency Lighting and Power Equipment

935-01.....Fluorescent-Lamp Ballasts

1029-94.....High-Intensity-Discharge Lamp Ballasts

1029A-06.....Outline of Investigation for Ignitors and Related Auxiliaries for HID Lamp Ballasts

1574-04.....Standard for Safety Track Lighting Systems

1598-21.....Standard for Safety Luminaires

2108-15.....Standard for Safety Low-Voltage Lighting Systems

8750-15.....Standard for Safety Light Emitting Diode (LED) Light Sources for Use in Lighting Products

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES

A. Shall be in accordance with NFPA, UL, as shown on drawings, and as specified.

B. Sheet Metal:

1. Shall be formed to prevent warping and sagging. Housing, trim, and lens frame shall be true, straight (unless intentionally curved), and parallel to each other as designed.
2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
3. When installed, any exposed fixture housing surface, trim frame, door frame, and lens frame shall be free of light leaks.
4. Hinged door frames shall operate smoothly without binding. Latches shall function easily by finger action without the use of tools.

C. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, aircraft cable, captive hinges, or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

D. Metal Finishes:

1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion-resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.

2. Interior light reflecting finishes shall be white with not less than 85 percent reflectance's, except where otherwise shown on the drawing.
3. Exterior finishes shall be as shown on the drawings.

E. Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.

2.2 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:

   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 or higher. Minimum Color Fidelity Index (IES Rf): 80 or higher.
   c. Color temperature between 3500° - 5000°K and as specified in the drawings' LIGHTING FIXTURE SCHEDULE.
   d. Minimum Rated Life: 50,000 hours per IES L70.
   e. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.

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.
   c. In addition to the above, the following is required for fixtures exceeding (20 pounds) in weight.
      1) Where fixtures mounted in ASTM Standard C635 "Intermediate Duty" and "Heavy Duty" ceilings and weigh between (20 pounds and 56 pounds), provide two 12-gauge safety hangers hung slack between diagonal corners of the fixture and the building structure.
      2) Where fixtures weigh over (56 pounds), they shall be independently supported from the building structure by approved hangers. Two-way angular bracing of hangers shall be provided to prevent lateral motion.
   d. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
7. Surface mounted lighting fixtures:
   a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum (1/4 inch) bolt, secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners and cross runners with special non-friction clip devices designed for the purpose, provided they bolt through the runner, or are also secured to the building structure by 12-gauge safety hangers. Studs or bolts securing fixtures weighing in excess of (56 pounds) shall be supported directly from the building structure.

b. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.

c. Fixtures less than (15 pounds) in weight and occupying less than (two square feet) of ceiling area may, when designed for the purpose, be supported directly from the outlet box when all the following conditions are met.

1) Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.

2) The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.

3) The outlet box is supported vertically from the building structure.

d. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.

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.

I. Dispose of lamps per requirements of Section 01 74 19, CONSTRUCTION WASTE MANAGEMEN/, and Section 02 41 00, DEMOLITION.

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 (Contracting Officer Representative). 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.

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. The scope of work is limited to the contractor routing Category 6a cabling from the elevator controllers(s) to the existing It equipment and making final Refer connection.

1. B. Refer to division 28 specification for fire alarm specification information.

1.2 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 (Contracting Officer Representative).
   Coordinate installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
2. 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 (005OP2H3) (202)461-5310 to have a government-accepted Telecommunications COR (Contracting Officer Representative) 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.

1.3 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.

1. Supply only test equipment with a calibration tag from Government-accepted calibration service dated not more than 12 months prior to test.
2. Provide sample test and evaluation reports.

H. Submittal Drawings:
   1. 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.
   2. Access Panel Schedule on Submittal Drawings: Coordinate and prepare a location, size, and function schedule of access panels required to fully service equipment.
I. Provide sustainable design submittals.
J. Furnish electronic certified test reports to COR (Contracting Officer Representative) prior to final inspection and not more than 90 days after completion of tests.

1.4 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 (Contracting Officer Representative).
   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 (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 (24 inches x 36 inches) with a minimum scale of (1/4 inch = 12 inches). ER, TR and other enlarged detail floor plan drawings to be D size (24” x 36”) with a minimum scale of (1/4 inch = 12 inches). Building composite floor plan drawings to be D size (24 inches x 36 inches) with a minimum scale of (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. Inputs and outputs of equipment identified according to labels installed on cables and equipment.
b. Device locations with labels.

c. Conduit.

d.

e. Wiring diagram.

5. Submit Record Wiring Diagrams within five business days after final cable testing.
6. Deliver Record Wiring Diagrams as CAD files in .dwg formats as determined by COR (Contracting Officer Representative).
7. Deliver four complete sets of electronic record wiring diagrams to COR (Contracting Officer Representative) 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.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. After approval and prior to installation, furnish COR (Contracting Officer Representative) with the following:
1. A (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.

1.6 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 (Contracting Officer Representative) 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.

1.7 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.

1.8 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.

1.9 PERFORMANCE AND DESIGN CRITERIA

A. Provide communications spaces and pathways conforming to TIA 569, at a minimum.

1.10 EQUIPMENT IDENTIFICATION

A. Provide laminated black phenomenon with a white core nameplate with minimum (1/4 inch) high engraved lettering.

B. Nameplates furnished by manufacturer as standard catalog items unless other method of identification is indicated.

1.11 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 (7 mils) thick and (3/4 inch) wide.

1.12 ACCESS PANELS

A. Panels: (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 with same fire rating classification as surface penetrated.

PART 2 - EXECUTION

2.1 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 (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 (Contracting Officer Representative)
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.

2.2 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 (Contracting Officer Representative) 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.

2.3 EQUIPMENT IDENTIFICATION

A. Install an identification sign which clearly indicates information required for use and maintenance of equipment.

B. Secure identification signs with screws.

2.4 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. Remove and replace defective work.
3. Remove and replace non-conforming work.

B. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.

C. Protect adjacent installations during cutting and patching operations.

D. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Patch finished surfaces and building components using new materials specified for original installation and experienced installers.

2.5 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 (Contracting Officer Representative) 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 (Contracting Officer Representative) 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.

2.6 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 (Contracting Officer Representative).

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 (Contracting Officer Representative).

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.

2.7 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 fireproofing 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.

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SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section identifies common and general grounding and bonding requirements of communication installations and applies to all sections of Divisions 27 and 28.

1.2 RELATED WORK

A. Low voltage wiring: Section 27 10 00, STRUCTURED CABLING.

1.3 SUBMITTALS

A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

B. Closeout Submittals: In addition to Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS provide the following:

1. Certified test reports of ground resistance.
2. Certifications: Two weeks prior to final inspection, submit following to COR (Contracting Officer Representative):
   a. Certification materials and installation is in accordance with construction documents.
   b. Certification complete installation has been installed and tested.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Grounding and Bonding Conductors:

1. Provide UL 83 insulated stranded copper equipment grounding conductors, with the exception of solid copper conductors for sizes (10 AWG) and smaller. Identify all grounding conductors with continuous green insulation color, except identify wire sizes (4 AWG) and larger per NEC.
2. Provide ASTM B8 bare stranded copper bonding conductors, except for ASTM B1 solid bare copper for wire sizes (10 AWG) and smaller.

B. Splices and Termination Components: Provide components meeting or exceeding UL 467 and clearly marked with manufacturer’s name, catalog number, and permitted conductor sizes.

C. Telecommunication System Ground Busbars:

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Conduit Systems:
   1. Bond ferrous metallic conduit to ground.
   2. Bond grounding conductors installed in ferrous metallic conduit at both ends of conduit using grounding bushing with #6 AWG conductor.

B. Boxes, Cabinets, and Enclosures:
   1. Bond each pull box, splice box, equipment cabinet, and other enclosures through which conductors pass (except for special grounding systems for intensive care units and other critical units shown) to ground.

C. Communications Cable Grounding:
   1. Bond all metallic cable sheaths in multi-pair communications cables together at each splicing or terminating location to provide 100 percent metallic sheath continuity throughout communications distribution system.
   2. Install a cable shield bonding connector with a screw stud connection for ground wire, at terminal points. Bond cable shield connector to ground.
   3. Bond all metallic cable shields together within splice closures using cable shield bonding connectors or splice case manufacturer’s splice case grounding and bonding accessories. When an external ground connection is provided as part of splice closure, connect to an effective ground source and bond all other metallic components and equipment at that location.

D. Communications Raceway Grounding:
   1. Conduit: Use insulated (6 AWG) bonding jumpers to bond metallic conduit at both ends and intermediate metallic enclosures to ground.

3.2 FIELD QUALITY CONTROL

A. Perform tests per BICSI’s Information Technology Systems Installation Methods Manual (ITSIMM), Recommended Testing Procedures and Criteria.

B. Perform two-point bond test using trained installers qualified to use test equipment.

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SECTION 27 05 33
RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies conduit, fittings, and boxes to form complete, coordinated, raceway systems. Raceways are required for communications cabling unless shown or specified otherwise.

1.2 SUBMITTALS

A. In accordance with Section 27 50 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, submit the following:
   1. Size and location of cabinets, splice boxes and pull boxes.
   2. Layout of required to conduit penetrations through structural elements.
   3. Catalog cuts marked with specific item proposed and area of application identified.

B. Certification: Provide letter prior to final inspection, certifying material is in accordance with construction documents and properly installed.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Minimum Conduit Size: m (1 1/4 inch).

B. Conduit:
   1. Electrical Metallic Tubing (EMT):
      a. Maximum Size: (4 inches).
      b. Install only for cable rated 600 volts or less.
      c. Conform to UL 797, ANSI C80.3.

C. Conduit Supports:
   1. Parts and Hardware: Provide zinc-coat or 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: Minimum (1-1/2 by 1-1/2 inch) (12 gage) steel, cold formed, lipped channels; with minimum (3/8 inch) diameter steel hanger rods.
   4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

D. Outlet, Splice, and Pull Boxes:
   1. Conform to UL-50 and UL-514A.
   2. Cast metal where required by NEC or shown and equipped with rustproof boxes.
   3. Sheet Metal Boxes: Galvanized steel, except where otherwise shown.
   4. Install flush mounted wall or ceiling boxes with raised covers so that front face of raised cover is flush with wall.
   5. Install surface mounted wall or ceiling boxes with surface style flat or raised covers.
E. Wireways: Equip with hinged covers, except where removable covers are shown.
F. Warning Tape: Standard, 4-Mil polyethylene (3 inch) wide tape detectable type, red with black letters, and imprinted with “CAUTION BURIED COMMUNICATIONS CABLE BELOW”.
G. Outlet Boxes:
   1. Flush wall mounted minimum (4-11/16 inches) square, (3-5/8 inches) deep pressed galvanized steel.
   2. Flush wall mounted (5 inches) square x (2-7/8 inches); deep pressed galvanized steel.
   3. 2-Gang Tile Box:
      a. Flush backbox type for installation in block walls.
      b. Minimum (3-5/8 inches) deep.
   4. Provide continuous welded top side wire to protect cable insulation and installers.
   5. High strength steel wires formed into a (2 inches by 4 inches) wire mesh pattern with intersecting wires welded together.
   6. Fittings: Field-formed, from straight sections, in accordance with manufacturer’s instructions.
   7. Provide accessories to protect, support, and install wire basket tray system.
H. Cable Duct: Equip with hinged covers, except where removable covers are accepted by COR (Contracting Officer Representative).
I. Cable Duct Fittings: As recommended by cable duct OEM.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Raceways typically required for cabling systems unless otherwise indicated:

System	Specification Section	Installed Method
Grounding	27 05 26	Conduit Not Required
Control, Communication and Signal Wiring	27 10 00	Complete Conduit Allowed in Non-Partitioned Cable Tray or Cable Ladders
Communications Structured Cabling	27 15 00	Conduit to Cable Tray Partitioned Cable Tray
Grounding and Bonding for Electronic Safety and Security	28 05 26	Conduit Not Required Unless Required by Code
Video Surveillance	28 23 00	Complete Conduit
Fire Detection and Alarm	28 31 00	Complete Conduit

B. Penetrations:

1. Cutting or Holes:

a. Locate holes in advance of installation. Where they are proposed in structural sections, obtain approval of structural engineer and COR prior to drilling through structural sections.

b. Make holes through concrete and masonry in existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand, or manual hammer type drills are not permitted; COR (Contracting Officer Representative) may grant limited permission by request, in condition of limited working space.

c. Fire Stop: Where conduits, wireways, and other communications raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.

1) Fill and seal clearances between raceways and openings with fire stop material.

2) Install only retrofittable, non-hardening, and reusable firestop material that can be removed and reinstalled to seal around cables inside conduits.

C. Conduit Installation:

1. Minimum conduit size of (3/4 inch), but not less than size required for 40 percent fill.

2. Install insulated bushings on all conduit ends.

3. Install pull boxes after every 180 degrees of bends (two 90-degree bends). Size boxes per TIA 569.
4. Extend vertical conduits/sleeves through floors minimum (3 inches) above floor and minimum (3 inches) below ceiling of floor below.
5. Terminate conduit runs to and from a backboard in a closet or interstitial space at top or bottom of backboard. Install conduits to enter telecommunication rooms next to wall and flush with backboard.
6. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections.
7. Seal empty conduits located in telecommunications rooms or on backboards with a standard non-hardening putty compound to prevent entrance of moisture and gases and to meet fire resistance requirements.
8. Minimum radius of communication conduit bends:

Sizes of Conduit Trade Size	Radius of Conduit Bends Inches
3/4	(6)
1	(9)
1-1/4	(14)
1-1/2	(17)
2	(21)
2-1/2	(25)
3	(31)
3-1/2	(36)
4	(45)

9. Provide pull wire in all empty conduits; sleeves through floor are exceptions.
10. Complete each entire conduit run installation before pulling in cables.
11. Flattened, dented, or deformed conduit is not permitted.
12. Ensure conduit installation does not encroach into ceiling height head room, walkways, or doorways.
13. Cut conduit square with a hacksaw, ream, remove burrs, and draw tight.
14. Install conduit mechanically continuous.

15. Independently support conduit at (8 feet) on center; do not use other supports (i.e., suspended ceilings, suspended ceiling supporting members, luminaires, conduits, mechanical piping, or mechanical ducts).
16. Support conduit within (1 foot) of changes of direction, and within (1 foot) of each enclosure to which connected.
17. Close ends of empty conduit with plugs or caps to prevent entry of debris, until cables are pulled in.
18. Attach conduits to cabinets, splice cases, pull boxes and outlet boxes with bonding type locknuts.
19. Unless otherwise indicated on drawings or specified herein, conceal conduits within finished walls, floors, and ceilings.
20. Conduit Bends:
    a. Make bends with standard conduit bending machines; observe minimum bend radius for cable type and outside diameter.
    b. Conduit hickey is permitted only for slight offsets, and for straightening stubbed conduits.
    c. Bending of conduits with a pipe tee or vise is not permitted.
21. Layout and Homeruns - Deviations: Make only where necessary to avoid interferences and only after drawings showing proposed deviations have been submitted and approved by COR (Contracting Officer Representative).

D. Concealed Work Installation:

E. Furred or Suspended Ceilings and in Walls:
1. EMT (Electrical Metallic Tubing). Different type conduits mixed indiscriminately in same system is not permitted.
2. Align and run conduit parallel or perpendicular to building lines.
3. Tightening set screws with pliers is not permitted.

F. Exposed Work Installation:
1. Unless otherwise indicated on drawings, exposed conduit is only permitted in telecommunications rooms.
    a. EMT (Electrical Metallic Tubing).
    b. Different type of conduits mixed indiscriminately in system is not permitted.
2. Align and run conduit parallel or perpendicular to building lines.
3. Install horizontal runs close to ceiling or beams and secure with conduit straps.

4. Support horizontal or vertical runs at not over 2400 mm (96 inches) intervals.
5. Surface Metal Raceways: Use only where shown on drawings.
6. Painting:
   a. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
   b. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color.
   c. Provide labels where conduits pass through walls and floors and at maximum (20 foot) intervals in between.

G. Expansion Joints:
1. Conduits (3 inches) and larger, that are secured to building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install couplings in accordance with manufacturer's recommendations.
2. Provide conduits smaller than (3 inches) with pull boxes on both sides of expansion joint. Connect conduits to expansion and deflection couplings as specified.
3. Install expansion and deflection couplings where shown.

H. Conduit Supports, Installation:
1. Select AC193 code listed mechanical anchors or fastening devices with safe working load not to exceed 1/4 of proof test load.
2. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is (8 foot) on center.
3. Support multiple conduit runs with trapeze hangers. Use trapeze hangers designed to support a load equal or greater than sum of the weights of the conduits, wires, hanger itself, and (200 pounds). Attach each conduit with U-bolts or other accepted fasteners.
4. Support conduit independent of pull boxes, luminaires, suspended ceiling components, angle supports, duct work, and similar items.
5. Fastenings and Supports in Solid Masonry and Concrete:
   a. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing concrete.
   b. Existing Construction:
      1) Code AC193 listed wedge type steel expansion anchors minimum 6 mm (1/4 inch) bolt size and minimum (1-1/8 inch) embedment.

2) Power set fasteners minimum (1/4 inch) diameter with depth of penetration minimum (3 inches).
3) Use vibration and shock resistant anchors and fasteners for attaching concrete ceilings.

6. Fastening to Hollow Masonry: Toggle bolts are permitted.
7. Fastening to Metal Structures: Use machine screw fasteners or other devices designed and accepted for application.
8. Bolts supported only by plaster or gypsum wallboard are not acceptable.
9. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
10. Do not support conduit from chain, wire, or perforated strap.
11. Spring steel type supports or fasteners are not permitted except horizontal and vertical supports/fasteners within walls.
12. Vertical Supports:
    a. Install riser clamps and supports for vertical conduit runs in accordance with NEC.
    b. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

I. Box Installation:
1. Boxes for Concealed Conduits:
    a. Flush mounted.
    b. Provide raised covers for boxes to suit wall or ceiling, construction, and finish.
2. In addition to boxes shown, install additional boxes where needed to prevent damage to cables during pulling.
3. 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.
4. Stencil or install phenolic nameplates on covers of boxes identified on riser diagrams; for example, "SIG-FA JB No. 1".
5. Outlet boxes mounted back-to-back in same wall are not permitted. A minimum (24 inches) center-to-center lateral spacing must be maintained between boxes.

3.2 TESTING

A. Examine fittings and locknuts for secureness.

B. Test EMT systems for electrical continuity.

C. Perform simple continuity test after cable installation.

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SECTION 27 15 00
COMMUNICATIONS STRUCTURED CABLING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies a complete and operating voice and digital structured cabling distribution system and associated equipment and hardware to be installed in VA Medical Center,

B. Wiring devices: Section 26 27 26, WIRING DEVICES.

C. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

D. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND

1.2 SUBMITTALS

A. In addition to requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS provide:

1. Submit drawing of conduit system on floor plan with quantity of Category cables indicated on floor plan.

B. Certifications:

1. Submit written certification from OEM indicating that proposed supervisor of installation and proposed provider of contract maintenance are authorized representatives of OEM. Include individual's legal name and address and OEM warranty credentials in the certification.
2. Pre-acceptance Certification: Submit in accordance with test procedures.
3. Test system cables and certify to COR (Contracting Officer Representative) before proof of performance testing can be conducted. Identify each cable as labeled on as-installed drawings.
4. Provide current and qualified test equipment OEM training certificates and product OEM installation certification for contractor installation, maintenance, and supervisory personnel.

C. Closeout Submittal: Provide document from OEM certifying that each item of equipment installed conforms to OEM published specifications.

1.3 WARRANTY

A. Work subject to terms of Article "Warranty of Construction," FAR clause 52.246-21.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. The contractor shall route Category 6A cabling from elevator controller to existing telecommunications equipment located within the existing IT and Date room (Refer to floor plans for locations).

B. The contractor shall terminate Category 6a cabling to existing telecommunications equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install for ease of operation, maintenance, and testing.

B. Install system to comply with NFPA 70 National Electrical Code, NFPA 99 Health Care Facilities, NFPA 101 Life Safety Code, Joint Commission Manual for Health Care Facilities, and original equipment manufacturers' (OEM) installation instructions.

C. Cable Systems Installation:

1. Install Category 6a cables within conduit raceway.
2. Bond to ground metallic cable sheaths, etc. (i.e., risers, underground, horizontal, etc.).

D. Labeling:

1. Industry Standard: Provide labeling in accordance with ANSI/TIA-606-B.
2. Print lettering of labels with laser printers handwritten labels are not acceptable.
3. Label both ends of all cables in accordance with industry standard. Provide permanent Labels in contrasting colors and identify according to system “Record Wiring Diagrams.”

3.2 MAINTENANCE

A. Accomplish the following minimum requirements for a one-year warranty period:

1. Respond and correct on-site trouble calls, during standard work week:
   a. A routine trouble call within one working day of its report. Routine trouble is considered a trouble which causes a system outlet, station, or patch cord to be inoperable.
   b. Standard work week is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal holidays.

2. Respond to an emergency trouble call within six hours of its report. An emergency trouble is considered a trouble which causes a subsystem or distribution point to be inoperable at any time.
3. Respond on-site to a catastrophic trouble call within four hours of its report. A catastrophic trouble call is considered total system failure.
   a. If a system failure cannot be corrected within four hours (exclusive of standard work time limits), provide alternate equipment, or cables within four hours after four-hour trouble shooting time.
   b. Routine or emergency trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) are also be deemed as a catastrophic trouble.
4. Provide COR (Contracting Officer Representative) written report itemizing each deficiency found and the corrective action performed during each official reported trouble call. Provide COR (Contracting Officer Representative) with sample copies of reports for review and approval at beginning of total system acceptance test.

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SECTION 28 05 00
COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section, Common Work Results for Electronic Safety and Security (ESS), applies to all sections of Division 28.

C. The Division 28 scope of work is limited to Fire Detection and Video Surveillance within the elevator cab. The new fire alarm devices shall be connected to existing fire alarm system, the new camera within the elevator cab shall be connected to the existing camera system. Please see drawings for additional information. The camera and emergency phone are furnished with the elevator; the contractor shall make connections to both systems with the levator cab.

1.2 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.

B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.

C. Section 14 21 00 - ELECTRIC TRACTION ELEVATORS. Requirements for elevators.

D. Section 14 24 00 - HYDRAULIC ELEVATORS. Requirements for elevators.

E. Section 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.

F. Section 26 05 21 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.

G. Section 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Requirements for infrastructure.

H. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.

I. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.

J. Section 28 05 28.33 - CONDUITS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.

1.3 QUALITY ASSURANCE

A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

B. Product Qualification:

1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

C. Contractor Qualification:

1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of five (5) years’ experience installing and servicing systems of similar scope and complexity. The Contractor shall be an authorized regional representative of the Security Management System’s (PACS) manufacturer. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity which became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system. The references must include a current point of contact, company or agency name, address, telephone number, complete system description, date of completion, and approximate cost of the project. The owner reserves the option to visit the reference sites, with the site owner’s permission and representative, to verify the quality of installation and the references’ level of satisfaction with the system. The Contractor shall provide copies of system manufacturer certification for all technicians. The Contractor shall only utilize factory-trained technicians to install, program, and service the PACS. The Contractor shall only utilize factory-trained technicians to install, terminate and service controller/field panels and reader modules. The technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems. The Contractor shall have a local service facility. The facility shall be located within 60 miles of the

project site. The local facility shall include sufficient spare parts inventory to support the service requirements associated with this contract. The facility shall also include appropriate diagnostic equipment to perform diagnostic procedures. The Resident Engineer reserves the option of surveying the company's facility to verify the service inventory and presence of a local service organization.

2. The Contractor shall provide proof project superintendent with BICSI Certified Commercial Installer Level 1, Level 2, or Technician to provide oversight of the project.
3. Cable installer must have on staff a Registered Communication Distribution Designer (RCDD) certified by Building Industry Consulting Service International. The staff member shall provide consistent oversight of the project cabling throughout design, layout, installation, termination, and testing.

D. 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 GENERAL ARANGEMENT OF CONTRACT DOCUMENTS

A. The Contract Documents supplement to this specification indicates approximate locations of equipment. The installation and/or locations of the equipment and devices shall be governed by the intent of the design; specification and Contract Documents, with due regard to actual site conditions, recommendations, ambient factors affecting the equipment and operations in the vicinity. The Contract Documents are diagrammatic and do not reveal all offsets, bends, elbows, components, materials, and other specific elements that may be required for proper installation. If any departure from the contract documents is deemed necessary, or in the event of conflicts, the Contractor shall submit details of such departures or conflicts in writing to the owner or owner's representative for his or her comment and/or approval before initiating work.

B. Anything called for by one of the Contract Documents and not called for by the others shall be of like effect as if required or called by all, except if a provision clearly designed to negate or alter a provision

contained in one or more of the other Contract Documents shall have the intended effect. In the event of conflicts among the Contract Documents, the Contract Documents shall take precedence in the following order: the Form of Agreement; the Supplemental General Conditions; the Special Conditions; the Specifications with attachments; and the drawings.

1.6 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.

C. 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.

D. 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, pictures, nameplate data and test reports as required.
3. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price, and availability of each part.

E. Submittals shall be in full compliance of the Contract Documents. All submittals shall be provided in accordance with this section. Submittals lacking the breath or depth these requirements will be considered incomplete and rejected. Submissions are considered multidisciplinary and shall require coordination with applicable divisions to provide a complete and comprehensive submission package. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings, and other data necessary for the Government to

ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted. Additional general provisions are as follows:

1. The Contractor shall schedule submittals in order to maintain the project schedule. For coordination drawings refer to Specification Section 01 33 10 - Design Submittal Procedures, which outline basic submittal requirements and coordination. Section 01 33 10 shall be used in conjunction with this section.
2. The Contractor shall identify variations from requirements of Contract Documents and state product and system limitations, which may be detrimental to successful performance of the completed work or system.
3. Each package shall be submitted at one (1) time for each review and include components from applicable disciplines (e.g., electrical work, architectural finishes, door hardware, etc.) which are required to produce an accurate and detailed depiction of the project.
4. Manufacturer’s information used for submittal shall have pages with items for approval tagged, items on pages shall be identified, and capacities and performance parameters for review shall be clearly marked through use of an arrow or highlighting. Provide space for Resident Engineer and Contractor review stamps.
5. Technical Data Drawings shall be in the latest version of AutoCAD®, drawn accurately, and in accordance with VA CAD Standards CAD Standard Application Guide, and VA BIM Guide. FREEHAND SKETCHES OR COPIED VERSIONS OF THE CONSTRUCTION DOCUMENTS WILL NOT BE ACCEPTED. The Contractor shall not reproduce Contract Documents or copy standard information as the basis of the Technical Data Drawings. If departures from the technical data drawings are subsequently deemed necessary by the Contractor, details of such departures and the reasons thereof shall be submitted in writing to the Resident Engineer for approval before the initiation of work.
6. Packaging: The Contractor shall organize the submissions according to the following packaging requirements.
   a. Binders: For each manual, provide heavy duty, commercial quality, durable three (3) ring vinyl covered loose leaf binders, sized to

receive 8.5 x 11 in paper, and appropriate capacity to accommodate the contents. Provide a clear plastic sleeve on the spine to hold labels describing the contents. Provide pockets in the covers to receive folded sheets.

1) Where two (2) or more binders are necessary to accommodate data, correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-referencing other binders where necessary to provide essential information for communication of proper operation and/or maintenance of the component or system.
2) Identify each binder on the front and spine with printed binder title, Project title or name, and subject matter covered. Indicate the volume number if applicable.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American National Standards Institute (ANSI)/ International Code Council (ICC):

A117.1.....Standard on Accessible and Usable Buildings and Facilities

C. American National Standards Institute (ANSI)/ Security Industry Association (SIA):

AC-03.....Access Control: Access Control Guideline Dye Sublimation Printing Practices for PVC Access Control Cards

CP-01-00.....Control Panel Standard-Features for False Alarm Reduction

PIR-01-00.....Passive Infrared Motion Detector Standard - Features for Enhancing False Alarm Immunity

TVAC-01.....CCTV to Access Control Standard - Message Set for System Integration

D. American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA):

330-09.....Electrical Performance Standards for CCTV Cameras

375A-76.....Electrical Performance Standards for CCTV Monitors

E. American National Standards Institute (ANSI):

ANSI S3.2-99.....Method for measuring the Intelligibility of Speech over Communications Systems

F. 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

C1238-97 (R03).....Standard Guide for Installation of Walk-Through Metal Detectors

D2301-04.....Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape

G. Architectural Barriers Act (ABA), 1968

H. Department of Justice: American Disability Act (ADA)

28 CFR Part 36-2010 ADA Standards for Accessible Design

I. Department of Veterans Affairs:

VHA National CAD Standard Application Guide, 2006

VA BIM Guide, V1.0 10

J. Federal Communications Commission (FCC):

(47 CFR 15) Part 15 Limitations on the Use of Wireless Equipment/Systems

K. Federal Information Processing Standards (FIPS):

FIPS-201-1.....Personal Identity Verification (PIV) of Federal Employees and Contractors

L. Federal Specifications (Fed. Spec.):

A-A-59544-08.....Cable and Wire, Electrical (Power, Fixed Installation)

M. Government Accountability Office (GAO):

GAO-03-8-02.....Security Responsibilities for Federally Owned and Leased Facilities

N. Homeland Security Presidential Directive (HSPD):

HSPD-12.....Policy for a Common Identification Standard for Federal Employees and Contractors

O. Institute of Electrical and Electronics Engineers (IEEE):

81-1983.....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

802.3af-08.....Power over Ethernet Standard

802.3at-09 .....Power over Ethernet (PoE) Plus Standard

C2-07.....National Electrical Safety Code

C62.41-02.....IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

C95.1-05.....Standards for Safety Levels with Respect to Human Exposure in Radio Frequency Electromagnetic Fields

P. International Organization for Standardization (ISO):

7810.....Identification cards – Physical characteristics

7811.....Physical Characteristics for Magnetic Stripe Cards

7816-1.....Identification cards - Integrated circuit(s) cards with contacts - Part 1: Physical characteristics

7816-2.....Identification cards - Integrated circuit cards - Part 2: Cards with contacts -Dimensions and location of the contacts

7816-3.....Identification cards - Integrated circuit cards - Part 3: Cards with contacts - Electrical interface and transmission protocols

7816-4.....Identification cards - Integrated circuit cards - Part 11: Personal verification through biometric methods

7816-10.....Identification cards - Integrated circuit cards - Part 4: Organization, security, and commands for interchange

14443.....Identification cards - Contactless integrated circuit cards; Contactless Proximity Cards Operating at 13.56 MHz in up to 5 inches distance

15693.....Identification cards -- Contactless integrated circuit cards - Vicinity cards; Contactless Vicinity Cards Operating at 13.56 MHz in up to 50 inches distance

19794.....Information technology - Biometric data interchange formats

Q. National Electrical Contractors Association

303-2005.....Installing Closed Circuit Television (CCTV) Systems

R. National Electrical Manufactures Association (NEMA):

250-08.....Enclosures for Electrical Equipment (1000 Volts Maximum)

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

S. National Fire Protection Association (NFPA):

70-11..... National Electrical Code (NEC)

731-08.....Standards for the Installation of Electric Premises Security Systems

99-2005.....Health Care Facilities

T. National Institute of Justice (NIJ)

0601.02-03.....Standards for Walk-Through Metal Detectors for use in Weapons Detection

0602.02-03.....Hand-Held Metal Detectors for Use in Concealed Weapon and Contraband Detection

U. National Institute of Standards and Technology (NIST):

IR 6887 V2.1.....Government Smart Card Interoperability Specification (GSC-IS)

Special Pub 800-37.....Guide for Applying the Risk Management Framework to Federal Information Systems

Special Pub 800-63.....Electronic Authentication Guideline

Special Pub 800-73-3....Interfaces for Personal Identity Verification (4 Parts)

.....Pt. 1- End Point PIV Card Application Namespace, Data Model & Representation

.....Pt. 2- PIV Card Application Card Command Interface

.....Pt. 3- PIV Client Application Programming Interface

.....Pt. 4- The PIV Transitional Interfaces & Data Model Specification

Special Pub 800-76-1....Biometric Data Specification for Personal Identity Verification

Special Pub 800-78-2....Cryptographic Algorithms and Key Sizes for Personal Identity Verification

Special Pub 800-79-1....Guidelines for the Accreditation of Personal Identity Verification Card Issuers

Special Pub 800-85B-1...DRAFTPIV Data Model Test Guidelines

Special Pub 800-85A-2...PIV Card Application and Middleware Interface Test Guidelines (SP 800-73-3 compliance)

Special Pub 800-96.....PIV Card Reader Interoperability Guidelines

Special Pub 800-104A....Scheme for PIV Visual Card Topography

V. Occupational and Safety Health Administration (OSHA):

29 CFR 1910.97.....Nonionizing radiation

W. Section 508 of the Rehabilitation Act of 1973

X. Security Industry Association (SIA):

AG-01 .....Security CAD Symbols Standards

Y. Underwriters Laboratories, Inc. (UL):

1-05.....Flexible Metal Conduit

5-04.....Surface Metal Raceway and Fittings

6-07.....Rigid Metal Conduit

44-05.....Thermoset-Insulated Wires and Cables

50-07.....Enclosures for Electrical Equipment

83-08.....Thermoplastic-Insulated Wires and Cables

294-99.....The Standard of Safety for Access Control System Units

305-08.....Standard for Panic Hardware

360-09.....Liquid-Tight Flexible Steel Conduit

444-08.....Safety Communications Cables

464-09.....Audible Signal Appliances

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

514A-04.....Metallic Outlet Boxes

514B-04.....Fittings for Cable and Conduit

51-05.....Schedule 40 and 80 Rigid PVC Conduit

609-96.....Local Burglar Alarm Units and Systems

634-07.....Standards for Connectors with Burglar-Alarm Systems

636-01.....Standard for Holdup Alarm Units and Systems

639-97.....Standard for Intrusion-Detection Units

651-05.....Schedule 40 and 80 Rigid PVC Conduit

651A-07.....Type EB and A Rigid PVC Conduit and HDPE Conduit

752-05.....Standard for Bullet-Resisting Equipment

797-07.....Electrical Metallic Tubing

827-08.....Central Station Alarm Services

1037-09.....Standard for Anti-theft Alarms and Devices

1635-10.....Digital Alarm Communicator System Units

1076-95.....Standards for Proprietary Burglar Alarm Units and Systems

1242-06.....Intermediate Metal Conduit

1479-03.....Fire Tests of Through-Penetration Fire Stops

1981-03.....Central Station Automation System

2058-05.....High Security Electronic Locks

60950.....Safety of Information Technology Equipment

60950-1.....Information Technology Equipment - Safety - Part 1: General Requirements

Z. Uniform Federal Accessibility Standards (UFAS) 1984

AA. United States Department of Commerce:

Special Pub 500-101 ....Care and Handling of Computer Magnetic Storage Media

1.8 COORDINATION

A. Coordinate arrangement, mounting, and support of electronic safety and security equipment:
   1. To allow maximum headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed.

1.9 MAINTENANCE & SERVICE

A. General Requirements
   1. The Contractor shall provide all services required and equipment necessary to maintain the entire integrated electronic security system in an operational state as specified for a period of one (1) year after formal written acceptance of the system. The Contractor shall provide all necessary material required for performing scheduled adjustments or other non-scheduled work. Impacts on facility operations shall be minimized when performing scheduled adjustments or other non-scheduled work. See also General Project Requirements.

B. Description of Work
   1. The adjustment and repair of the security system includes all software updates, panel firmware, and the following new items computers equipment, communications transmission equipment and data transmission media (DTM), local processors, security system sensors,

physical access control equipment, facility interface, signal transmission equipment, and video equipment.

C. Personnel

1. Service personnel shall be certified in the maintenance and repair of the selected type of equipment and qualified to accomplish all work promptly and satisfactorily. The Resident Engineer shall be advised in writing of the name of the designated service representative, and of any change in personnel. The Resident Engineer shall be provided with copies of system manufacturer certification for the designated service representative.

D. Schedule of Work

1. The work shall be performed during regular working hours, Monday through Friday, excluding federal holidays.

E. System Inspections

1. These inspections shall include:
   a. The Contractor shall perform two (2) minor inspections at six (6) month intervals or more if required by the manufacturer, and two (2) major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
      1) Minor Inspections shall include visual checks and operational tests of all console equipment, peripheral equipment, local processors, sensors, electrical and mechanical controls, and adjustments on printers.
      2) Major Inspections shall include all work described for Minor Inspections and the following: clean all system equipment and local processors including interior and exterior surfaces; perform diagnostics on all equipment; operational tests of the CPU, switcher, peripheral equipment, recording devices, monitors, picture quality from each camera; check, walk test, and calibrate each sensor; run all system software diagnostics and correct all problems; and resolve any previous outstanding problems.

F. Emergency Service

1. The owner shall initiate service calls whenever the system is not functioning properly. The Contractor shall provide the Owner with an emergency service center telephone number. The emergency service

center shall be staffed 24 hours a day 365 days a year. The Owner shall have sole authority for determining catastrophic and non-catastrophic system failures within parameters stated in General Project Requirements.

a. For catastrophic system failures, the Contractor shall provide same day four (4) hour service response with a defect correction time not to exceed eight (8) hours from [notification] [arrival on site]. Catastrophic system failures are defined as any system failure that the Owner determines will place the facility(s) at increased risk.

b. For non-catastrophic failures, the Contractor within eight (8) hours with a defect correction time not to exceed 24 hours from notification.

G. Operation

1. Performance of scheduled adjustments and repair shall verify operation of the system as demonstrated by the applicable portions of the performance verification test.

H. Records & Logs

1. The Contractor shall maintain records and logs of each task and organize cumulative records for each component and for the complete system chronologically. A continuous log shall be submitted for all devices. The log shall contain all initial settings, calibration, repair, and programming data. Complete logs shall be maintained and available for inspection on site, demonstrating planned and systematic adjustments and repairs have been accomplished for the system.

I. Work Request

1. The Contractor shall separately record each service call request, as received. The record shall include the serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing the action taken, the amount and nature of the materials used, and the date and time of commencement and completion. The Contractor shall deliver a record of the work performed within five (5) working days after the work was completed.

J. System Modifications

1. The Contractor shall make any recommendations for system modification in writing to the Resident Engineer. No system modifications, including operating parameters and control settings, shall be made without prior written approval from the Resident Engineer. Any modifications made to the system shall be incorporated into the operation and maintenance manuals and other documentation affected.

K. Software

1. The Contractor shall provide all software updates when approved by the Owner from the manufacturer during the installation and 12-month warranty period and verify operation of the system. These updates shall be accomplished in a timely manner, fully coordinated with the system operators, and incorporated into the operations and maintenance manuals and software documentation. There shall be at least one (1) scheduled update near the end of the first year’s warranty period, at which time the Contractor shall install and validate the latest released version of the Manufacturer’s software. All software changes shall be recorded in a log maintained in the unit control room. An electronic copy of the software update shall be maintained within the log. At a minimum, the contractor shall provide a description of the modification, when the modification occurred, and name and contact information of the individual performing the modification. The log shall be maintained in a white 3 ring binder and the cover marked “SOFTWARE CHANGE LOG”.

1.10 MINIMUM REQUIREMENTS

A. References to industry and trade association standards and codes are minimum installation requirement standards.

B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.11 DELIVERY, STORAGE, & HANDLING

A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:

1. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required.

2. Damaged equipment shall be, as determined by the Resident Engineer, placed in first-class operating condition, or be returned to the source of supply for repair or replacement.
3. Painted surfaces shall be protected with factory installed removable heavy craft paper, sheet vinyl or equal.
4. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer, so repaired areas are not obvious.

B. Central Station, Workstations, and Controllers:
1. Store in temperature and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 10 to 30 deg C (50 to 85 deg F), and not more than 80 percent relative humidity, non-condensing.
2. Open each container; verify contents against packing list, and file copy of packing list, complete with container identification for inclusion in operation and maintenance data.
3. Mark packing list with designations which have been assigned to materials and equipment for recording in the system labeling schedules generated by cable and asset management system.
4. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.12 PROJECT CONDITIONS

A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
1. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of 2 to 50 deg C (36 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 1 enclosure.
2. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of -18 to 50 deg C (0 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 4X enclosures.

3. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of -34 to 50 deg C (-30 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to (85 mph) and snow cover up to (24 in) thick. NEMA 250, Type 4X enclosures.
4. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
5. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X enclosures.

B. Security Environment: Use vandal resistant enclosures in high-risk areas where equipment may be subject to damage.

C. Console: All console equipment shall, unless noted otherwise, be rated for continuous operation under ambient environmental conditions of 15.6 to 29.4 deg C (60 to 85 deg F) and a relative humidity of 20 to 80 percent.

1.13 EQUIPMENT AND MATERIALS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.

B. When more than one unit of the same class of 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 unit assembled.
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 shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified:

1. The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the Resident Engineer a minimum of 15 working days prior to the manufacturers making the factory tests.
2. Four copies of certified test reports containing all test data shall be furnished to the Resident Engineer prior to final inspection and not more than 90 days after completion of the tests.
3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

1.14 ELECTRICAL POWER

A. Electrical power of 120 Volts Alternating Current (VAC) shall be indicated on Division 26 drawings. Additional locations requiring primary power required by the security system shall be shown as part of these contract documents. Primary power for the security system shall be configured to switch to emergency backup sources automatically if interrupted without degradation of any critical system function. Alarms shall not be generated as a result of power switching, however, an indication of power switching on (on-line source) shall be provided to the alarm monitor. The Security Contractor shall provide an interface (dry contact closure) between the PACS and the Uninterruptible Power Supply (UPS) system, so the UPS trouble signals and main power fail appear on the PACS operator terminal as alarms.

B. Failure of any on-line battery shall be detected and reported as fault condition. Battery backed-up power supplies shall be provided sized for 8 hours of operation at actual connected load. Requirements for additional power or locations shall be included with the contract to support equipment and systems offered. The following minimum requirements shall be provided for power sources and equipment.

1. Emergency Generator
   a. Report Printers: Unit Control Room
   b. Video Monitors: Unit Control Room
   c. Intercom Stations
   d. Radio System

e. Lights: Unit Control Room, Equipment Rooms, & Security Offices
f. Outlets: Security Outlets dedicated to security equipment racks or security enclosure assemblies.
g. Security Device Power Supplies (DGP, VASS, Card Access, Lock Power, etc.) powered from the security closets or remotely: various locations
h. Telephone/Radio Recording Equipment: Unit Control Room.
i. VASS Camera Power Supplies: Security Closets
j. VASS Pan/Tilt Units: Various Locations
k. VASS Outdoor Housing Heaters and Blowers: Various Sites
l. Intercom Master Control System
m. Fiber Optic Receivers/Transmitters
n. Security office Weapons Storage
o. Outlets that charge handheld radios

2. Uninterruptible Power Supply (UPS) on Emergency Power
   a. The following 120VAC circuits shall be provided by others. The Security Contractor shall coordinate exact locations with the Electrical Contractor:
      1) Security System Monitors and Keyboards: Control Room
      2) CPU: Control Equipment Room
      3) Communications equipment: Control Equipment Room and various sites.
      4) VASS Matrix Switcher: Control Equipment Room
      5) VASS: Control Equipment Room
      6) Digital Video Recorders, encoders & decoders: Control Room
      7) All equipment Room racked equipment.
      8) Network switches

1.15 TRANSIENT VOLTAGE SUPPRESSION, POWER SURGE SUPPLESION, & GROUNDING

A. Transient Voltage Surge Suppression: All cables and conductors extending beyond building façade, except fiber optic cables, which serve as communication, control, or signal lines shall be protected against Transient Voltage surges and have Transient Voltage Surge Suppression (TVSS) protection. The TVSS device shall be UL listed in accordance with Standard TIA 497B installed at each end. Lighting and surge suppression shall be a multi-strike variety and include a fault indicator. Protection shall be furnished at the equipment and additional triple solid state surge protectors rated for the

application on each wire line circuit shall be installed within 914.4 mm (3 ft) of the building cable entrance. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode to verify there is no interference.

1. A 10-microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
2. An 8-microsecond rise time by 20-microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.
3. Maximum series current: 2 AMPS. Provide units manufactured by Advanced Protection Technologies, model # TE/FA 10B or TE/FA 20B.
4. Operating Temperature and Humidity: -40 to 85 deg C (-40 to 185 deg F), 0 to 95 percent relative humidity.

B. Grounding and Surge Suppression

1. The Security Contractor shall provide grounding and surge suppression to stabilize the voltage under normal operating conditions. To ensure the operation of over current devices, such as fuses, circuit breakers, and relays, underground-fault conditions.
2. Security Contractor shall engineer and provide proper grounding and surge suppression as required by local jurisdiction and prevailing codes and standards referenced in this document.
3. Principal grounding components and features. Include main grounding buses and grounding and bonding connections to service equipment.
4. Details of interconnection with other grounding systems. The lightning protection system shall be provided by the Security Contractor.
5. Locations and sizes of grounding conductors and grounding buses in electrical, data, and communication equipment rooms and closets.
6. AC power receptacles are not to be used as a ground reference point.
7. Any cable that is shielded shall require a ground in accordance with the best practices of trade and manufactures installation instructions.
8. Protection should be provided at both ends of cabling.

1.16 COMPONENT ENCLOSURES

A. Construction of Enclosures

1. Consoles, power supply enclosures, detector control and terminal cabinets, control units, wiring gutters, and other component

housings, collectively referred to as enclosures, shall be so formed and assembled as to be sturdy and rigid.

2. Thickness of metal in-cast and sheet metal enclosures of all types shall not be less than those in Tables I and II, UL 611. Sheet steel used in fabrication of enclosures shall be not less than 14 gauge. Consoles shall be 16-gauge.
3. Doors and covers shall be flanged. Enclosures shall not have pre-punched knockouts. Where doors are mounted on hinges with exposed pins, the hinges shall be of the tight pin type, or the ends of hinge pins shall be tack welded to prevent removal. Doors having a latch edge length of less than (24 in) shall be provided with a single construction core. Where the latch edge of a hinged door is more than (24 in) or more in length, the door shall be provided with a three-point latching device with construction core; or alternatively with two, one located near each end.
4. Any ventilator openings in enclosed rooms and cabinets shall conform to the requirements of UL 611. Unless otherwise indicated, sheet metal enclosures shall be designed for wall mounting with tip holes slotted. Mounting holes shall be in positions that remain accessible when all major operating components are in place, and the door is open but shall be accessible when the door is closed.
5. Covers of pull and junction boxes provided to facilitate initial installation of the system shall be held in place by tamper proof Torx Center post security screws. Stenciled or painted labels shall be affixed to such boxes indicating they contain no connections. These labels shall not indicate the box is part of the Electronic Security System (ESS).

B. Consoles & Equipment Racks: All consoles and vertical equipment racks shall include a forced air-cooling system to be provided by others.

1. Vertical Equipment Racks:
   a. The forced air blowers shall be installed in the vented top of each cabinet and shall not reduce usable rack space.
   b. The forced air fan shall consist of one fan rated at 105 CFM per rack bay and noise level shall not exceed 55 decibels.
   c. d. Vertical equipment racks are to be provided with full sized clear plastic locking doors and vented top panels as shown on contract drawings.

2. Console racks:
   a. Forced air fans shall be installed in the top rear of each console bay. The forced air fan shall consist of one fan rated at 105 CFM mounted to a 133mm vented blank panel the noise level of each fan shall not exceed 55 decibels. The fans shall be installed so air is pulled from the bottom of the rack or cabinet and exhausted out the top.
   b. Console racks are to be provided with flush mounted hinged rear doors with recessed locking latch on the bottom and middle sections of the consoles. Provide code access to support wiring for devices located on the work surfaces.

C. Tamper Provisions and Tamper Switches:
   1. Enclosures, cabinets, housings, boxes and fittings or every product description having hinged doors or removable covers and which contain circuits, or the integrated security system and its power supplies shall be provided with cover operated, corrosion-resistant tamper switches.
   2. Tamper switches shall be arranged to initiate an alarm signal that will report to the monitoring station when the door or cover is moved. Tamper switches shall be mechanically mounted to maximize the defeat time when enclosure covers are opened or removed. It shall take longer than 1 second to depress or defeat the tamper switch after opening or removing the cover. The enclosure and tamper switch shall function together in such a manner as to prohibit direct line of sign to any internal component before the switch activates.
   3. Tamper switches shall be inaccessible until the switch is activated. Have mounting hardware concealed so the location of the switch cannot be observed from the exterior of the enclosure. Be connected to circuits which are under electrical supervision at all times, irrespective of the protection mode in which the circuit is operating. Be spring-loaded and held in the closed position by the door or cover and be wired so they break the circuit when the door cover is disturbed. Tamper circuits shall be adjustable type screw sets and shall be adjusted by the contractor to eliminate nuisance alarms associated with incorrectly mounted tamper device shall annunciate prior to the enclosure door opening (within 1/4

"tolerance. The tamper device or its components shall not be visible or accessing with common tools to bypass when the enclosure is in the secured mode.

4. The single gang junction boxes for the portrait alarming and pull boxes with less than will not require tamper switches.
5. All enclosures over shall be hinged with an enclosure lock.
6. Control Enclosures: Maintenance/Safety switches on control enclosures, which must be opened to make routing maintenance adjustments to the system and to service the power supplies, shall be push/pull-set automatic reset type.
7. Provide one (1) enclosure tamper switch for each 609 linear mm of enclosure lock side opening evenly spaced.
8. All security screws shall be Torx-Post Security Screws.
9. The contractor shall provide the owner with two (2) torx-post screwdrivers.

1.17 ELECTRONIC COMPONENTS

A. All electronic components of the system shall be of the solid-state type, mounted on printed circuit boards conforming to UL 796. Boards shall be plug-in, quick-disconnect type. Circuitry shall not be so densely placed as to impede maintenance. All power-dissipating components shall incorporate safety margins of not less than 25 percent with respect to dissipation ratings, maximum voltages, and current-carrying capacity.

1.18 SUBSTITUTE MATERIALS & EQUIPMENT

A. Where variations from the contract requirements are requested in accordance with the GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, 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.

B. In addition to this Section the Security Contractor shall also reference Section II, Products, and associated divisions. The Resident Engineer shall have final authority on the authorization or refusal of substitutions. If there are no proposed substitutions, a statement in writing from the Contractor shall be submitted to the Resident Engineer stating same. In the preparation of a list of substitutions, the following information shall be included, as a minimum:

1. Identity of the material or devices specified for which there is a proposed substitution.
2. Description of the segment of the specification where the material or devices are referenced.
3. Identity of the proposed substitute by manufacturer, brand name, catalog or model number and the manufacturer’s product name.
4. A technical statement of all operational characteristic expressing equivalence to items to be substituted and comparison, feature-by-feature, between specification requirements and the material or devices called for in the specification, and Price differential.

C. Materials Not Listed: Furnish all necessary hardware, software, programming materials, and supporting equipment required to place the specified major subsystems in full operation. Note that some supporting equipment, materials, and hardware may not be described herein. Depending on the manufacturers selected by the COR (Contracting Officer Representative) some equipment, materials and hardware may not be contained in either the Contract Documents or these written specifications but are required by the manufacturer for complete operation according to the intent of the design and these specifications. In such cases, the Resident Engineer shall be given the opportunity to approve the additional equipment, hardware and materials that shall be fully identified in the bid and in the equipment list submittal. The Resident Engineer shall be consulted in the event there is any question about which supporting equipment, materials, or hardware is intended to be included.

D. Response to Specification: The Contractor shall submit a point-by-point statement of compliance with each paragraph of the security specification. The statement of compliance shall list each paragraph by number and indicate “COMPLY” opposite the number for each paragraph where the Contractor fully complies with the specification. Where the proposed system cannot meet the requirements of the paragraph, and does not offer an equivalent solution, the offers shall indicate “DOES NOT COMPLY” opposite the paragraph number. Where the proposed system does not comply with the paragraph as written, but the bidder feels it will accomplish the intent of the paragraph in a manner different from that described, the offers shall indicate “COMPARABLE.” The offers shall include a statement fully describing the “comparable” method of

satisfying the requirement. Where a full and concise description is not provided, the offered system shall be considered as not complying with the specification. Any submission that does not include a point-by-point statement of compliance, as described above, shall be disqualified. Submittals for products shall be in precise order with the product section of the specification. Submittals not in proper sequence will be rejected.

1.19 LIKE ITEMS

A. Where two or more items of equipment performing the same function are required, they shall be exact duplicates produced by one manufacturer. All equipment provided shall be complete, new, and free of any defects.

1.20 WARRANTY

A. The Contractor shall, as a condition precedent to the final payment, execute a written guarantee (warranty) to the COR (Contracting Officer Representative) certifying all contract requirements have been completed according to the final specifications. Contract drawings and the warranty of all materials and equipment furnished under this contract are to remain in satisfactory operating condition (ordinary wear and tear, abuse and causes beyond his control for this work accepted) for one (1) year from the date the Contactor received written notification of final acceptance from the COR (Contracting Officer Representative). Demonstration and training shall be performed prior to system acceptance. All defects or damages due to faulty materials or workmanship shall be repaired or replaced without delay, to the COR (Contracting Officer Representative) satisfaction, and at the Contractor's expense. The Contractor shall provide quarterly inspections during the warranty period. The contractor shall provide written documentation to the COR (Contracting Officer Representative) on conditions and findings of the system and device(s). In addition, the contractor shall provide written documentation of test results and stating what was done to correct any deficiencies. The first inspection shall occur 90 calendar days after the acceptance date. The last inspection shall occur 30 calendar days prior to the end of the warranty. The warranty period shall be extended until the last inspection and associated corrective actions are complete. When equipment and labor covered by the Contractor's warranty, or by a manufacturer's warranty, have been replaced or restored because of its

failure during the warranty period, the warranty period for the replaced or repaired equipment or restored work shall be reinstated for a period equal to the original warranty period, and commencing with the date of completion of the replacement or restoration work. In the event any manufacturer customarily provides a warranty period greater than one (1) year, the Contractor's warranty shall be for the same duration for that component.

1.22 SINGULAR NUMBER

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.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. All equipment associated within the Security Control Room, Security Console and Security Equipment Room shall be UL 827, UL 1981, and UL 60950 compliant and rated for continuous operation. Environmental conditions (i.e., temperature, humidity, wind, and seismic activity) shall be taken under consideration at each facility and site location prior to installation of the equipment.

B. All equipment shall operate on 120 or 240 volts alternating current (VAC); 50 Hz or 60 Hz AC power system unless documented otherwise in subsequent sections listed within this specification. All equipment shall have a back-up source of power that will provide a minimum of [8] <insert hours> hours of run time in the event of a loss of primary power to the facility.

C. The system shall be designed, installed, and programmed in a manner that will allow for ease of operation, programming, servicing, maintenance, testing, and upgrading of the system.

D. All equipment and materials for the system will be compatible to ensure correct operation.

2.2 EQUIPMENT ITEMS

A. The Security Management System shall provide full interface with all components of the security subsystem as follows:

1. Shall allow for communication between the Physical Access Control System and Database Management and all subordinate work and monitoring stations, enrollment centers for badging and biometric

devices as part of the PACS, local annunciation centers, the electronic Security Management System (SMS), and all other VA redundant or backup command center or other workstations locations.

2. Shall provide automatic continuous communication with all systems that are monitored by the SMS and shall automatically annunciate any communication failures or system alarms to the SMS operator providing identification of the system, nature of the alarm, and location of the alarm.
3. Controlling devices shall be utilized to interface the SMS with all field devices.
4. The Security control room and security console will be supported by an uninterrupted power supply (UPS) or dedicated backup generator power circuit.
5. The Security Equipment room, Security Control Room, and Security Operator Console shall house the following equipment i.e., refer to individual master specifications for each security subsystem’s specific requirements:
   a. Security Console Bays and Equipment Racks
   b. Security Network Server and Workstation
   c. CCTV Monitoring, Controlling, and Recording Equipment
   d. PACS Monitoring and Controlling Equipment
   e. IDS Monitoring and Controlling Equipment
   f. Security Access Detection Monitoring Equipment
   g. EPPS Monitoring and Controlling Equipment
   h. Main Panels for all Security Systems
   i. Power Supply Units (PSU) for all field devices
   j. Life safety and power monitoring equipment
   k. All other building systems deemed necessary by the VA to include, but not limited to, heating, ventilation and air conditioning (HVAC), elevator control, portable radio, fire alarm monitoring, and other potential systems.
   l. Police two-way radio control consoles/units.

B. Security Console Bays - shall be EIA 310D compliant and:
1. Utilize stand-up, sit-down, and vertical equipment racks in any combination to monitor and control the security subsystems.
2. Shall be wide enough for equipment that requires a minimum 19-inch mounting area.

3. Shall be made of metal, furnished with wire ways, a power strip, a thermostatic controlled bottom or top mounted fan units, a hinge mounted rear door, a hinge mounted front door made of Plexiglas, and a louvered top. When possible, prefabricated (standard off-the-shelf) security console equipment shall be used in place of customized designed consoles.
4. A wire management system should be designed and installed so that all cables are mounted in a manner that they do not interfere with day-to-day operations, are labeled for quick identification, and so that high voltage power cables do not cause signal interference with low voltage and data carrying cables.
5. Shall be mounted on lockable casters.
6. Shall be ergonomically designed so that all devices requiring repetitive interaction with the operator can be easily accessed, observed, and accomplished.
7. Controls and displays shall be located so that they are not obscured during normal operation. Control and display units installed with a work bench shall be a minimum of 3 in. from all edges of the work bench area.
8. All security subsystem controls shall be installed within the same operating console bay of their associated equipment.
9. Video monitors shall be mounted above all controls within a console bay and positioned in a manner that minimum strain is placed on the operator viewing them at the console.
10. At least one workbench for every three (3) console bays shall be provided with free of control equipment to allow for appropriate operator’s workspace.
11. All console devices shall be labeled and marked with a minimum of quarter inch bold print.
12. All non-security related equipment that is required to be monitored shall be installed in a console bay separate from the security subsystem equipment and clearing be identified as such.
13. Console bays and related equipment shall be arranged in priority order and sequenced based upon their pre-defined security subsystem operations criticality established by the Contracting Officer.

14. The following minimum console technical characteristics shall be taken into consideration when designing for and installing the security console and equipment racks:

C. Security Console Configuration:

1. The size shall be defined by the number of console bays required to house and operate the security subsystems, as well as any other factors that may influence the overall design of the space. A small Access Control System and Database Management shall contain no more than four (4) security console bays. A large Access Control System and Database Management shall contain no less than five (5) and no more than eight (8) security console bays.
2. Shall meet the following minimum spacing requirements to ensure that an Access Control System and Database Management is provided to house existing and future security subsystems and other equipment listed in paragraph 2.3.C:
   a. 500 square feet for a large Access Control System and Database Management.
   b. 300 square feet for a small Access Control System and Database Management.
   c. If office, training room and conference space, is a processing area as well as holding cell space is to be located adjacent to the Access Control System and Database Management, these space requirements also need to be considered.
3. Shall be located in an area within, at a minimum, the first level/line of security defense defined by the VA. If the Access Control System and Database Management is to be located outside the first level of security, then the area shall be constructed or retrofit to meet or exceed those requirements outlined in associated VA Master Specifications.
4. Shall not be located within or near an area with little to no blast mitigation standoff space protection, adjacent to an outside wall exposed to vehicle parking and traffic, within a basement or potential flood zone area, in close approximately to major utility areas, or near an exposed air intake(s).
5. Access shall meet UFAS and ADA accessibility requirements.
6. Construction shall be slab to slab and free of windows, with the exception of a service window. All penetrations into the room shall

be sealed with fire stopping materials. This material shall apply in accordance with Section 07 84 00, FIRESTOPPING.

7. A service window shall be installed in the wall next to the main entrance of the Access Control System and Database Management or where it best can be monitored and accessed by the security console operator. The window shall meet all requirements set forth in UL 752, to include at a minimum, Class III ballistic level protection. The windows shall be set in a minimum or four (4) inches solid concrete units to ceiling height with either masonry or gypsum wall board to the underside of the slab above. It shall also contain a service tray constructed in a manner that only objects no larger than 3 inches in width may pass through it.
8. The walls making up or surrounding the Access Control System and Database Management shall be made of materials that at a minimum offer Class III ballistic level protection for the security console operator(s).
9. There will be a main power cut-off button/switch located inside the Access Control System and Database Management in the event of an electrical fire or related event occurs.
10. Shall have a fire alarm detection unit that is tied into the main building fire alarm system and have at least two fire extinguishers located within it.
11. Shall utilize a fire suppression system similar to that used by the VA’s computer and telecommunications room operating areas.
12. The floor shall be raised a minimum of 4 inches from the concrete floor base. Wire ways shall be utilized under the raised floor for separation of signal and power wires and cables.
13. Access shall be monitored and controlled by the PACS via card reader and fixed camera that utilizes a wide-angle lens. A 1 in. deadbolt shall be utilized as a mechanical override for the door in the event of electrical failure of the PACS, card reader, or locking mechanism.
14. There shall only be one point of ingress and egress to and from the Security Control Room. The door shall be made of solid core wood or better. If a window is required for the door, then the window shall be ballistic resistant with a Millar covering.

15. A two-way intercom shall be placed at the point of entry into the Security Control Room for access-communication control purposes.
16. A remote push-button door unlocking device shall not be installed for the electronic PACS locking mechanism providing access control into the Security Control Room.
17. All controlling equipment and power supplies that must be wall mounted shall be mounted in a manner that maximizes usability of the Security Control Room wall space. All equipment shall be mounted to three quarter inch fire retardant plywood. The plywood shall be fastened to the wall from slab to slab and fixed to the existing walls supports.

D. Security Control Room Ventilation
1. Shall meet or exceed all requirements laid out in VA Master Specification listed in Division 23, HEATING, VENTILATION, AND AIR CONDITIONING.
2. Controls shall be via a separate air handling system that provides an isolated supply and return system. The Security Control Room shall have a dedicated thermostat control unit and cut-off switch to be able to shut off ventilation to the control room in the event of a chemical, biological, or radiological (CBR) event or other related emergency.
3. There shall be a louver installed in the control room door to assist with ventilation of the room. The louver shall be exactly 12 x 12 inches and closeable.

E. Security Control Room and Security Console Lighting:
1. The following factors shall be taken into consideration for lighting of the Security Control Room and console area:
   a. Shadows: To reduce eye strain and fatigue, shadows shall be avoided.
   b. Glare: The readability of all display panels, labels, and equipment shall not be interfered with or create visibility problems.
2. The following table shall provide guidance on the amount of footcandles required per work area and type of task performed:

Work Area/Type of Task	Footcandles
Main Operating Panels	50
Secondary Display Panels	50

Seated Workstations		100
Reading	Handwriting	100
	Typed Documents	50
	Visual Display Units	10
Logbook Recording		100
Maintenance Area		50
Emergency/Back-up Lighting		10

F. Remote security console access: For facilities that have a remote, secondary back-up control console or workstation shall apply the following requirements:
   1. The secondary stations shall the requirements outlined in Sections 2.2.A-G.
   2. Installation of an intercom station or telephone line shall be installed and provide direct one touch call-up for communications between the primary Security Control Console and secondary Security Control Console.
   3. Secondary stations shall not have priority over a primary Security Control Console.
   4. The primary Access Control System and Database Management shall have the ability to shut off power and a signal to a secondary control station in the event the area has been compromised.

G. Wires and Cables:
   1. Shall meet or exceed the manufactures recommendation for power and signals.
   2. Shall be carried in an enclosed conduit system, utilizing electromagnetic tubing (EMT) to include the equivalent in flexible metal, rigid galvanized steel (RGS) to include the equivalent of liquid tight, polyvinylchloride (PVC) schedule 40 or 80.
   3. All conduits will be sized and installed per the NEC. All security system signal and power cables that traverse or originate in a high security office space will contained in either EMT or RGS conduit.
   4. All conduit, pull boxes, and junction boxes shall be marked with colored permanent tape or paint that will allow it to be distinguished from all other infrastructure conduit.
   5. Conduit fills shall not exceed 50 percent unless otherwise documented.

6. A pull string shall be pulled along and provided with signal and power cables to assist in future installations.
7. At all locations where there is a wall penetration or core drilling is conducted to allow for conduit to be installed, fire stopping materials shall be applied to that area.
8. High voltage and signal cables shall not share the same conduit and shall be kept separate up to the point of connection. High voltage for the security subsystems shall be any cable or sets of cables carrying 30 VDC/VAC or higher.
9. For all equipment that is carrying digital data between the Security Control Room, Security Equipment Room, Security Console, or at a remote monitoring station, it shall not be less that 20 AWG and stranded copper wire for each conductor. The cable or each individual conductor within the cable shall have a shield that provides 100% coverage. Cables with a single overall shield shall have a tinned copper shield drain wire.

2.3 FIBER OPTIC EQUIPMENT

A. 8 Channel Fiber Optic Transcievers (Video&PTZ Control)

1. The field-located and central-located fiber optic transceivers shall utilize wave division multiplexing to transmit and receive video and data pan-tilt-zoom control signals over two standard 62.5/125 multimode fibers.
2. The units shall be capable of operating over a range of 2 km.
3. The units shall be NTSC color compatible.
4. The units shall support data rates up to 64 Kbps.
5. The units shall be surface or rack mountable.
6. The units shall be UL listed.
7. The units shall meet or exceed the following specifications:
   a. Video
      1) Input/Output: 1-volt pk-pk (75 ohms)
      2) Input/Output Channels:8
      3) Bandwidth:10 Hz - 6.5 MHZ per channel
      4) Differential Gain:<2%
      5) Differential Phase:<0.7°
      6) Tilt:<1%
      7) Signal to Noise Ratio:60 dB
   b. Data (Control)

1) Data Channels: 2
2) Data Format:RS-232, RS-422, 2 wire or 4 wire RS-485 with Tri-State Manchester Bi-Phase and Sensornet
3) Data Rate: DC - 100 kbps (NRZ)
4) Bit Error Rate:< 1 in 10-9 @ Maximum Optical Loss Budget
5) Operating Mode: Simplex or Full-Duplex
6) Wavelength:1310/1550 nm, Multimode or Singlemode
7) Optical Emitter: Laser Diode
8) Number of Fibers:1

c. Connectors
1) Optical: ST
2) Power and Data: Terminal Block with Screw Clamps
3) Video: BNC (Gold Plated Center-Pin)

d. Electrical and Mechanical
1) Power: 2 VDC 500 mA (stand-alone)
3) Current Protection: Automatic Resettable Solid-State Current Limiters

e. Environmental
1) MTBF: > 100,000 hours
2) Operating Temp: -40 to 74 deg C (-40 to 165 deg F)
3) Storage Temp: -40 to 85 deg C (-40 to 185 deg F)
4) Relative Humidity: 0% to 95% (non-condensing)

B. Fiber Optic Transmitters: The central-located fiber optic transmitters shall utilize wave division multiplexing to transmit video and signals over standard 62.5/125 multimode fibers.
1. The units shall be capable of operating over a range of 4.8 km.
2. The units shall be NTSC color compatible.
3. The units shall support data rates up to 64 Kbps.
4. The units shall be surface or rack mountable.
5. The units shall be UL listed.
6. The units shall meet or exceed the following specifications:

a. Video
1) Input: 1-volt pk-pk (75 ohms)
2) Bandwidth: 5H2 - 10 MHZ
3) Differential Gain: <5%
4) Tilt: <1%
5) Signal-Noise: 60db

6) Wavelength: 850nm
7) Number of Fibers: 1
8) Operating Temp: -20 to 70 deg C (-4 to 158 deg F)
9) Connectors:
   a) Power: Female plug with screw clamps
   b) Video: BNC
   c) Optical: ST
10) Power: 12 VDC

C. Fiber Optic Receivers: The field-located fiber optic receivers shall utilize wave division multiplexing to receive video signals over standard 62.5/125 multimode fiber.
   1. The units shall be capable of operating over a range of 4.8 km.
   2. The units shall be NTSC color compatible.
   3. The units shall support data rates up to 64 Kbps.
   4. The units shall be surface or rack mountable.
   5. The units shall be UL listed.
   6. The units shall meet or exceed the following specifications:
      a. Video
         1) Output: 1-volt pk-pk (75 ohms)
         2) Bandwidth: 5H2 - 10 MHZ
         3) Differential Gain: <5%
         4) Tilt: <1%
         5) Signal-Noise: 60dB
         6) Wavelength: 850nm
         7) Number of Fibers: 1
         8) Surface Mount: (4.2 x 3.5 x 1 in)
         9) Operating Temp: -20 to 70 deg C (-4 to 158 deg F)
         10) Connectors:
         11) Power: Female plug block with screw clamps
         12) Video: BNC
         13) Optical: ST
         14) Power: 12 VAC8 Channel Fiber Optic Transcievers (Video&PTZ Control)

D. Fiber Optic Sub Rack with Power Supply
   1. The Card Cage Rack shall provide high-density racking for fiber-optic modules. The unit shall be designed to mount in standard (19

in) instrument racks and to accommodate the equivalent of 15 1-inch modules.

a. Specifications

1) Card Orientation: Vertical
2) Construction: Aluminum
3) Current Consumption: 0.99 A
4) Humidity: 95.0 % RH
5) Input Power: 100-240 VAC, 60/50 Hz
6) Mounting: Mounts in standard (19 in) rack using four (4) screws (optional wall brackets purchased separately)
7) Number of Outputs: 1.0
8) Number of Slots 15.0
9) Operating Temperature: -40 to +75 deg C (-40.0 to 167.0 deg F)
10) Output Voltage: 13.5 V
11) Output Current 6.0 A
12) Power Dissipation: 28.0 W
13) Power Factor: 48.0
14) Power Supply: (built-in)
15) Rack Units: 3RU
16) Redundant Capability: Yes
17) Weight: (5.35 lbs.)
18) Width: (19.0 in)

2.4 TRANSIENT VOLTAGE SURGE SUPPRESSION DEVICES (TVSS) AND SURGE SUPPRESION

A. Transient Voltage Surge Suppression

1. All cables and conductors extending beyond building perimeter, except fiber optic cables, which serve as communication, control, or signal lines shall be protected against Transient Voltage surges and have Transient Voltage surge suppression protection (TVSS) UL listed in accordance with Standard 497B installed at each end. Lighting and surge suppression shall be a multi-strike variety and include a fault indicator. Protection shall be furnished at the equipment and additional triple solid state surge protectors rated for the application on each wire line circuit shall be installed within 915 mm (36 in) of the building cable entrance. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode using the following waveforms:

a. A 10-microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
b. An 8-microsecond rise time by 20-microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.
c. Maximum series current: 2 AMPS. Provide units manufactured by Advanced Protection Technologies, model # TE/FA 10B or TE/FA 20B or approved equivalent.
d. Operating Temperature and Humidity: -40 to + 85 deg C (-40 to 185 deg F), and 0 to 95 percent relative humidity, non-condensing.

B. Physical Access Control Systems
1. Suppressors shall be installed on AC power at the point of service and shall meet the following criteria:
a. UL1449 2nd Edition, 2007, listed
b. UL1449 S.V.R. of 400 Volts or lower
c. Status Indicator Light(s)
d. Minimum Surge Current Capacity: 40,000 Amps (8 x 20 µsec)
e. Maximum Continuous Current: 15 Amps
f. MCOV: 125 VAC
g. Service Voltage: 110-120 VAC
2. Suppressors shall be installed on the Low Voltage circuit at both the point of entrance and exit of the building. Suppressors shall meet the following criteria:
a. UL 497B
b. Minimum Surge Current Capacity: 2,000 Amps per pair
c. Maximum Continuous Current: 5 Amps
d. MCOV: 33 Volts
e. Service Voltage: 24Volts
3. Suppressors shall be installed on the communication circuit between the access controller and card reader at both the entrance and exit of the building. Suppressors shall meet the following criteria:
a. Conforms with UL497B standards (where applicable)
b. Clamp level for 12 and 24V power: 18VDC / 38VDC
c. Clamp level for Data/LED: 6.8VDC
d. Service Voltage for Power: 12VDC/24VDC
e. Service Voltage for Data/LED: <5VDC

f. Clamp level – PoE Access Power: 72V
g. Clamp level – PoE Access Data: 7.9V
h. Service Voltage – PoE Access: 48VAC – 54VAC
i. Service Voltage – PoE Data: <5VDC

C. Intercom Systems
1. Suppressors shall be installed on the AC power at the point of service and shall meet the following criteria:
a. UL 1449 Listed
b. UL 1449 S.V.R. of 400 Volts or lower
c. Diagnostic Indicator Light(s)
d. Integrated ground terminating post (where case/chassis ground exists)
e. Minimum Surge Current Capacity of 13,000 Amps (8 x 20 µSec)
2. Suppressors shall be installed on incoming central office lines and shall meet the following criteria:
a. UL 497A Listed
b. Multistage protection design
c. Auto-reset current protection not to exceed 2 Amps per pair
d. Minimum Surge Current of 500 Amps per pair (8 x 20 µSec)
3. Suppressors shall be installed on all telephone/intercom circuits that enter or leave separate buildings and shall meet the following criteria:
a. UL 497A Listed (where applicable)
b. UL 497B Listed (horns, strobes, speakers, or communication circuits over 300 feet)
c. Multistage protection design
d. Auto-reset over-current protection not to exceed 5 Amps per pair
e. Minimum Surge Current of 1000 Amps per pair (8 x 20 µSec)

D. Intrusion Detection Systems
1. Suppressors shall be installed on AC at the point of service and shall meet the following criteria:
a. UL 1449, 2nd Edition 2007, listed
b. UL 1449 S.V.R. of 400 Volts or lower
c. Status Indicator Lights
d. Center screw for terminating Class II transformers
e. Minimum Surge Current Capacity of 32,000 Amps (8 x 20 µSec)

2. Suppressors shall be installed on all Telephone Communication Interface circuits and shall meet the following criteria:
   a. UL 497A Listed
   b. Multistage protection design
   c. Surge Current Capacity: 9,000 Amps (8x20 µSec)
   d. Clamp Voltage: 130Vrms
   e. Auto reset current protection not to exceed 150 Milliamps
3. Suppressors shall be installed on all burglar alarm initiating and signaling loops and addressable circuits which enter or leave separate buildings. The following criteria shall be met:
   a. UL 497B for data communications or annunciation powered loops)
   b. Fail-short/fail-safe mode.
   c. Surge Current Capacity: 9,000 Amps (8x20 µSec)
   d. Clamp Voltage: 15 Vrms
   e. Joule Rating: 76 Joules per pair (10x1000 µSec)
   f. Auto-reset current protection not to exceed 150 Milliamps for UL 497A devices.

E. Video Surveillance System
1. Protectors shall be installed on coaxial cable systems on points of entry and exit from separate buildings. Suppressors shall be installed at each exterior camera location and include protection for 12 and/or 24-volt power, data signal, and motor controls (for Pan, Tilt and Zoom systems). SPDs shall protect all modes herein mentioned and contain all modes in a single unit system. Protection for all systems mentioned above shall be incorporated at the headend equipment. Additionally, a minimum 450VA battery backup shall be used to protect the DVR or VCR and m. tor. Protectors shall meet the following criteria:
   a. Head-End Power
      1) UL 1778, cUL (Battery Back Up)
      2) Minimum Surge Current Capacity: 65,000 Amps (8x20µsec)
      3) Minimum of two (2) NEMA 5-15R Receptacles (one (1) AC power only, one (1) with UPS)
      4) All modes protected (L-N, L-G, N-G)
      5) EMI/RFI Filtering
      6) Maximum Continuous Current: 12 Amps
   b. Camera Power

1) Minimum Surge Current Capacity: 1,000 Amps (8X20µsec); 240 Amps for IP Video/PoE cameras
2) Screw Terminal Connection
3) All protection modes L-G (all Lines)
4) MCOV <40VAC

c. Video And Data
1) Surge Current Capacity 1,000 Amps per conductor
2) “BNC” Connection (Coax)
3) Protection modes: L-G (Data), Center Pin-G, Shield-G (Coax)
4) Band Pass 0-2GHz
5) Insertion Loss <0.3dB

F. Grounding and Surge Suppression
1. The Security Contractor shall provide grounding and surge suppression to stabilize the voltage under normal operating conditions. This is to ensure the operation of current devices, such as fuses, circuit breakers, relays, underground-fault conditions.
2. The Contractor shall engineer, provide, ad install proper grounding and surge suppression as required by local jurisdiction and prevailing codes and standards, referenced in this document.
3. Principal grounding components and features shall include main grounding buses, grounding, and bonding connections to service equipment.
4. The Contractor shall provide detail drawings of interconnection with other grounding systems including lightning protection systems.
5. The Contractor shall provide details of locations and sizes of grounding conductors and grounding buses in electrical, data, and communication equipment rooms and closets.
6. AC power receptacles are not to be used as a ground reference point.
7. Any cable that is shielded shall require a ground in accordance with applicable codes, the best practices of the trade, and all manufactures’ installation instructions.

G. 120 VAC Surge Suppression
1. Continuous Current: Unlimited (parallel connection)
2. Max Surge Current: 13,500 Amps
3. Protection Modes: L - N, L - G, N - G
4. Warranty: Ten Year Limited Warranty
5. Dimension: (2.90 x 1.62 x 2.05 in)

6. Weight: (0.18 lbs.)
7. Housing: ABS

2.5 INSTALLATION KIT

A. General:

1. The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal, or punch block. Unfinished or unlabeled wire connections shall not be allowed. All unused and partially opened installation kit boxes, coaxial, fiber-optic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware shall be turned over to the Contracting Officer. The following sections outline the minimum required installation sub-kits to be used:
2. System Grounding:
   a. The grounding kit shall include all cable and installation hardware required. All head end equipment and power supplies shall be connected to earth ground via internal building wiring, according to the NEC.
   b. This includes, but is not limited to:
      1) Coaxial Cable Shields
      2) Control Cable Shields
      3) Data Cable Shields
      4) Equipment Racks
      5) Equipment Cabinets
      6) Conduits
      7) Cable Duct blocks
      8) Cable Trays
      9) Power Panels
      10) Grounding
      11) Connector Panels
3. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.

4. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
5. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.
6. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.
7. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to label each subsystem according to the OEM requirements, as-installed drawings, and this document.
8. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to provide the system documentation as required by this document and explained herein.

PART 3 – EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION

A. Comply with NECA 1.
B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
D. Equipment: Install facilities to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
E. Right of Way: Give to piping systems installed at a required slope.

F. Equipment location shall be as close as practical to locations shown on the drawings.

G. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment that is not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
2. "Conveniently accessible" is defined as being capable of being reached 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.

3.2 FIRESTOPPING

A. Apply firestopping penetrations of fire-rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section 07 84 00 "Firestopping."

3.3 COMMISIONING

A. Provide commissioning documentation in accordance with the requirements of Section 28 08 00 – COMMISIONIN OF ELECTRONIC SAFETY AND SECURITY SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.

B. Components provided under this section of the specification will be tested as part of a larger system. Refer to section 28 08 00 – COMMISIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.4 DEMONSTRATION AND TRAINING

A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

B. Training shall be provided for the particular equipment or system as required in each associated specification.

C. A training schedule shall be developed and submitted by the contractor and approved by the Resident Engineer at least 30 days prior to the planned training.

D. Provide services of manufacturer’s technical representative for <insert hours> hours to instruct VA personnel in operation and maintenance of units.

E. Submit training plans and instructor qualifications in accordance with the requirements of Section 28 08 00 – COMMISIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

3.5 WORK PERFORMANCE

A. Job site safety and worker safety is the responsibility of the contractor.

B. For work on existing stations, arrange, phase, and perform work to assure electronic safety and security service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

C. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

D. Coordinate location of equipment and conduit with other trades to minimize interferences. See the GENERAL CONDITIONS.

3.6 SYSTEM PROGRAMMING

A. General Programming Requirements

1. This following section shall be used by the contractor to identify the anticipated level of effort (LOE) required setup, program, and configure the Electronic Security System (ESS). The contractor shall be responsible for providing all setup, configuration, and programming to include data entry for the Security Management System (SMS) and subsystems [(e.g., video matrix switch, intercoms, digital video recorders, intrusion devices, including integration of subsystems to the SMS (e.g., camera call up, time synchronization, intercoms)]. System programming for existing or new SMS servers shall not be conducted at the project site.

B. Level of Effort for Programming

1. The Contractor shall perform and complete system programming (including all data entry) at an offsite location using the Contractor’s own copy of the SMS software. The Contractor’s copy of the SMS software shall be of the Owners current version. Once system programming has been completed, the Contractor shall deliver the

data to the Resident Engineer on data entry forms and an approved electronic medium, utilizing data from the contract documents. The completed forms shall be delivered to the Resident Engineer for review and approval at least 90 calendar days prior to the scheduled date the Contractor requires it. The Contractor shall not upload system programming until the Resident Engineer has provided written approval. The Contractor is responsible for backing up the system prior to uploading new programming data. Additional programming requirements are provided as follows:

a. Programming for New SMS Server: The contractor shall provide all other system related programming. The contractor will be responsible for uploading personnel information (e.g., ID Cards backgrounds, names, access privileges, personnel photos, access schedules, personnel groupings) along with coordinating with Resident Engineer for device configurations, standards, and groupings. VA shall provide database to support Contractor’s data entry tasks. The contractor shall anticipate a weekly coordination meeting and working with Resident Engineer to ensure data uploading is performed without incident of loss of function or data loss.
b. Programming for Existing SMS Servers: The contractor shall perform all related system programming except for personnel data as noted. The contractor will not be responsible for uploading personnel information (e.g., ID Cards backgrounds, names, access privileges, access schedules, personnel groupings). The contractor shall anticipate a weekly coordination meeting and working alongside Resident Engineer to ensure data uploading is performed without incident of loss of function or data loss. System programming for SMS servers shall be performed by using the Contractor’s own server and software. These servers shall not be connected to existing devices or systems at any time.

2. The Contractor shall identify and request from the Resident Engineer, any additional data needed to provide a complete and operational system as described in the contract documents.
3. Contractor and Resident Engineer coordination on programming requires a high level of coordination to ensure programming is performed in accordance with VA requirements and programming uploads

do not disrupt existing systems' functionality. The contractor shall anticipate a minimum a weekly coordination meeting. Contractor shall ensure data uploading is performed without incident of loss of function or data loss. The following Level of Effort Chart is provided to communicate the expected level of effort required by contractors on VA ESS projects. Calculations to determine actual levels of effort shall be confirmed by the contractor before project award.

Description of Systems	Develop System Loading Sheets	Coordination	Initial Set-up Configuration	Graphic Maps	System Programming	Final Checks	Level of Effort (Typical Tasks)
SMS Setup & Configuration	e.g., program monitoring stations, programming networks, interconnections between CCTV, intercoms, time synchronization	e.g., retrieve IP addresses, naming conventions, standard event descriptions, programming templates, coordinate special system needs	e.g., Load system Operating System and Application software, general system configurations	e.g., develop naming conventions, develop file folders, confirming accuracy of AutoCAD Floor Plans, convert file into jpeg file	e.g., program monitoring stations, programming networks, interconnections between CCTV, intercoms, time synchronization	e.g., check all system diagnostics (e.g., clients, panels)	Load and set-up 4-6 CDs and configure servers (to configure Loading and Configuring software Administrative account, audit log, Keystrokes, mouse clicks, multi-screen configuration

Electronic Entry Control Systems	e.g., setup of device, door groups & schedules, REX, Locks, link graphics	e.g., confirming device configurations, naming conventions, event description, and narratives	e.g., enter data from loading sheets; configure components, link events, cameras, and graphics		e.g., setup of device, door groups & schedules, REX, Locks, link graphics	e.g., performing entry testing to confirm correct set-up and configuration	e.g., creating a door, door configuration, adding request to exit, door monitors and relays, door timers, door related events (e.g., access, access denied, forced open, held open), linkages, controlled areas, advanced door monitoring, time zones, sequence of operations

Intrusion Detection Systems	e.g., enter door groups & schedules, link devices - REX, lock, & graphics	e.g., confirming device configurations, naming conventions, event description, and narratives	e.g., enter data from loading sheets; configure components, link events, cameras, and graphics		e.g., enter door groups & schedules, link devices - REX, lock, & graphics	e.g., walk test, device position, and masking	e.g., setting up monitoring and control points (e.g., motion sensors, glass breaks, vibration sensor, strobes, sounders) creating intrusion zones, creating arm/disarm panel, timed sequences, time zones, icon placements on graphic maps, clearance levels, events (e.g., armed, disarmed, zone violation, device alarm activations), LCD reader messages,

Intercoms Systems	e.g., programming events & call-ups	e.g., confirming device configurations, naming conventions, event description, and narratives	e.g., enter data from loading sheets; configure components, link events, cameras, and graphics		e.g., programming events & call-ups	e.g., confirm operation, SMS event generation and camera call-up	e.g., setup linkages, events for activations, device troubles, land devices on graphic maps
Console Monitoring Components	N/A	per monitor	per monitor	per graphic map	N/A	per monitor	N/A
Note: Programming tasks are supported through the contractor’s development of the Technical Data Package Submittals.							

Table 1 Contractor Level of Effort

3.7 TESTING AND ACCEPTANCE

A. Performance Requirements

1. General:

a. The Contractor shall perform contract field, performance verification, and endurance testing and make adjustments of the completed security system when permitted. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing. Written notification of planned testing shall be given to the Resident Engineer at least 60 calendar days prior to the test and after the Contractor has received written approval of the specific test procedures.

b. The COR (Contracting Officer Representative) shall witness all testing and system adjustments during testing. Written permission shall be obtained from the Resident Engineer before proceeding with the next phase of testing. Original copies of all data produced during performance verification and endurance testing shall be turned over to the Resident Engineer at the conclusion of each phase of testing and prior to Resident Engineer approval of the test.

2. Test Procedures and Reports: The test procedures, compliant w/ VA standard test procedures, shall explain step-by-step actions in detail and expected results demonstrating compliance with the requirements of the specification. The test reports shall be used to document results of the tests. The reports shall be delivered to the Resident Engineer within seven (7) calendar days after completion of each test.

B. Pre-Delivery Testing

1. The purpose of the pre-delivery test is to establish that a system is suitable for installation. As such, pre-delivery test shall be a mock-up of the system as planned in the contract documents. The Contractor shall assemble the Security Test System at the Contractors local project within 50-miles of the project site and perform tests to demonstrate the performance of the system complies with the contract requirements in accordance with the approved pre-delivery test procedures. The tests shall take place during regular daytime working hours on weekdays. Model numbers of equipment tested shall be identical to those to be delivered to the site. Original

copies of all data produced during pre-delivery testing, including results of each test procedure, shall be documented and delivered to the Resident Engineer at the conclusion of pre-delivery testing and prior to Resident Engineer’s approval of the test. The test report shall be arranged so all commands, stimuli, and responses are correlated to allow logical interpretation. For Existing System modifications, the contractor shall provide their own server with loaded applicable software to support PDT.

2. Test Setup: The pre-delivery test setup shall include the following:
   a. All console equipment.
      1) At least one of each type of data transmission media (DTM) and associated equipment to provide a fully integrated PACS.
      2) The number of local processors shall equal the amount required by the site design.
      3) Enough sensor simulators to provide alarm signal inputs to the system equal to the number of sensors required by the design. The alarm signals shall be manually, or software generated.
      4) Contractor to prove to owner all systems are appropriately sized and configured as sized.
      5) Integration of VASS, intercom systems, other subsystems.
3. During the bidding process the contractor shall submit a request for information to the Owner to determine if a pre-delivery test will be required. If a pre-delivery test is not required, the contractor shall provide a written notification that the Pre-delivery Test is not required in their shop drawings submission.

//C. Intermediate Testing

1. After completion of 30-50 percent of the installation of ESS cabinet(s) and equipment, one local and remote-control stations and prior to any further work, this portion of the system must be pretested, inspected, and certified. Each item of installed equipment shall be checked to ensure appropriate FCC listing & UL certification labels are affixed, NFPA, Emergency, Safety, and JCAHCO guidelines are followed, and proper installation practices are followed. The intermediate test shall include a full operational test.

D. The inspection and test will be conducted by a factory-certified contractor representative and witnessed by a Government Representative.

The results of the inspection will be officially recorded by a designated Government Representative and maintained on file by the Resident Engineer (RE), until completion of the entire project. The results will be compared to the Acceptance Test results.

E. Contractor’s Field Testing (CFT)

1. The Contractor shall calibrate and test all equipment, verify DTM operation, place the integrated system in service, and test the integrated system. Ground rods installed by this Contractor within the base of camera poles shall be tested as specified in IEEE STD 142. The Contractor shall test all security systems and equipment and provide written proof of a 100% operational system before a date is established for the system acceptance test. Documentation package for CFT shall include completed (fully annotated details of test details) for each device and system tested, and annotated loading sheets documenting complete testing to Resident Engineer approval. CFT test documentation package shall conform to submittal requirements outlined in this Section. The Contractor’s field-testing procedures shall be identical to the Resident Engineer’s acceptance testing procedures. The Contractor shall provide the Resident Engineer with a written listing of all equipment and software indicating all equipment and components have been tested and passed. The Contractor shall deliver a written report to the Resident Engineer stating the installed complete system has been calibrated, tested, and is ready to begin performance verification testing; describing the results of the functional tests, diagnostics, and calibrations; and the report shall also include a copy of the approved acceptance test procedure. Performance verification testing shall not take place until written notice by contractor is received certifying that a contractor’s field test was successful.

F. Performance Verification Test (PVT)

1. Test team:

a. After the system has been pretested and the Contractor has submitted the pretest results and certification to the Resident Engineer, then the Contractor shall schedule an acceptance test to date and give the Resident Engineer written, notice as described herein, prior to the date the acceptance test is

expected to begin. The system shall be tested in the presence of a Government Representative, an OEM certified representative, representative of the Contractor and other approved by the Resident Engineer. The system shall be tested utilizing the approved test equipment to certify proof of performance, FCC, UL, and Emergency Service compliance. The test shall verify that the total system meets all the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.

2. The Contractor shall demonstrate the completed Physical Access Control System PACS complies with the contract requirements. In addition, the Contractor shall provide written certification that the system is 100% operational prior to establishing a date for starting PVT. Using approved test procedures, all physical and functional requirements of the project shall be demonstrated and shown. The PVT will be stopped and aborted as soon as 10 technical deficiencies are found requiring correction. The Contractor shall be responsible for all travel and lodging expenses incurred for out-of-town personnel required to be present for resumption of the PVT. If the acceptance test is aborted, the re-test will commence from the beginning with a retest of components previously tested and accepted.
3. The PVT, as specified, shall not begin until receipt of written certification that the Contractors Field Testing was successful. This shall include certification of successful completion of testing as specified in paragraph “Contractor’s Field Testing,” and upon successful completion of testing at any time when the system fails to perform as specified. Upon termination of testing by the Resident Engineer or Contractor, the Contractor shall commence an assessment period as described for Endurance Testing Phase II.
4. Upon successful completion of the acceptance test, the Contractor shall deliver test reports and other documentation, as specified, to the Resident Engineer prior to commencing the endurance test.
5. Additional Components of the PVT shall include:
   a. System Inventory
      1) All Device equipment
      2) All Software

3) All Logon and Passwords
4) All Cabling System Matrices
5) All Cable Testing Documents
6) All System and Cabinet Keys

b. Inspection
1) Contractor shall record an inspection punch list noting all system deficiencies. The contractor shall prepare an inspection punch list format for Resident Engineers approval.
2) As a minimum the punch list shall include a listing of punch list items, punch list item location, description of item problem, date noted, date corrected, and details of how item was corrected.

6. Partial PVT - At the discretion of Resident engineer, the Performance Verification Test may be performed in part should a 100% complaint CFT be performed. In the event that a partial PVT will be performed instead of a complete PVT; the partial PVT shall be performed by testing 10% of the system. The contractor shall perform a test of each procedure on select devices or equipment.

G. Endurance Test
1. The Contractor shall demonstrate the specified probability of detection and false alarm rate requirements of the completed system. The endurance test shall be conducted in phases as specified below. The endurance test shall not be started until the Resident Engineer notifies the Contractor, in writing, that the performance verification test is satisfactorily completed, training as specified has been completed, and correction of all outstanding deficiencies has been satisfactorily completed. VA shall operate the system 24 hours per day, including weekends and holidays, during Phase I and Phase III endurance testing. VA will maintain a log of all system deficiencies. The Resident Engineer may terminate testing at any time the system fails to perform as specified. Upon termination of testing, the Contractor shall commence an assessment period as described for Phase II. During the last day of the test, the Contractor shall verify the appropriate operation of the system. Upon successful completion of the endurance test, the Contractor shall deliver test reports and other documentation as specified to the Resident Engineer prior to acceptance of the system.

2. Phase I (Testing): The test shall be conducted 24 hours per day for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized in writing by the Resident Engineer. If the system experiences no failures, the Contractor may proceed directly to Phase III testing after receiving written permission from the Resident Engineer.
3. Phase II (Assessment):
   a. After the conclusion of Phase I, the Contractor shall identify all failures, determine causes of all failures, repair all failures, and deliver a written report to the Resident Engineer. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and recommend the point at which testing should be resumed.
   b. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the Resident Engineer. The meeting shall not be scheduled earlier than five (5) business days after the Resident Engineer receives the report. As part of this test review meeting, the Contractor shall demonstrate all failures have been corrected by performing appropriate portions of the performance verification test. Based on the Contractor’s report and the test review meeting, the Resident Engineer will provide a written determine of either the restart date or require Phase I be repeated.
4. Phase III (Testing): The test shall be conducted 24 hours per day for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized in writing by the COR (Contracting Officer Representative).
5. Phase IV (Assessment):
   1. After the conclusion of Phase III, the Contractor shall identify all failures, determine causes of all failures, repair all failures, and deliver a written report to the COR (Contracting Officer Representative). The report shall explain in detail the nature of each failure, corrective action taken, results of tests

performed, and recommend the point at which testing should be resumed.

2. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the COR (Contracting Officer Representative). The meeting shall not be scheduled earlier than five (5) business days after receipt of the report by the COR (Contracting Officer Representative). As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by repeating appropriate portions for the performance verification test. Based on the review meeting the test should not be scheduled earlier than five (5) business days after the Resident Engineer receives the report. As a part of this test review meeting, the Contractor shall demonstrate all failures have been corrected by repeating appropriate portions of the performance verification test. Based on the Contractor’s report and the test review meeting, the Resident Engineer will provide a written determine of either the restart date or require Phase III be repeated. After the conclusion of any re-testing which the Resident Engineer may require, the Phase IV assessment shall be repeated as if Phase III had just been completed.

H. Exclusions

1. The Contractor will not be held responsible for failures in system performance resulting from the following:
   a. An outage of the main power in excess of the capability of any backup power source provided the automatic initiation of all backup sources was accomplished and that automatic shutdown and restart of the PACS performed as specified.
   b. Failure of an Owner furnished equipment or communications link, provided the failure was not due to Contractor furnished equipment, installation, or software.
   c. Failure of existing Owner owned equipment, provided the failure was not due to Contractor furnished equipment, installation, or software.

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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 of the conductors and cables required for a fully functional for electronic safety and security (ESS) system.

1.2 RELATED WORK

A. Section 28 05 00 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. Requirements for general requirements that are common to more than one section in Division 28.

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 QUALITY ASSURANCE

A. See section 28 05 00, Paragraph 1.4.

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 (Contracting Officer Representative) 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

1479-03.....Fire Tests of Through-Penetration Fire Stops//

1.6 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end.

PART 2 - PRODUCTS

2.1 GENERAL

A. Support of Open Cabling: NRTL labeled for support of Category 6a cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars and spools.
3. Straps and other devices.

2.2 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.

2.3 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, size per manufacturer recommendations.

2.4 IDENTIFICATION PRODUCTS

A. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.5 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.

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 and not more than 6 inches 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. 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 (Contracting Officer Representative).

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. Unless otherwise specified in other sections install wiring and connect to equipment/devices to perform the required functions as shown and specified.

E. 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.

F. System voltages shall be 120 volts or lower where shown on the drawings or as required by the NEC.

G. 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.

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

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.
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

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.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

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 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 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, PHYSICAL ACCESS CONTROL for connecting, terminating, and identifying wires and cables.

B. Comply with requirements in Division 28 Section "INTRUSION DETECTION" for connecting, terminating, and identifying wires and cables.

C. Comply with requirements in Division 28 Section "VIDEO SURVEILLANCE" for connecting, terminating, and identifying wires and cables.

D. Comply with requirements in Division 28 Section "ELECTRONIC PERSONAL PROTECTION SYSTEMS" for connecting, terminating, and identifying wires and cables.

E. 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 requirements in Division 07 Section "PENETRATION FIRESTOPPING."

B. Comply with TIA/EIA-569-A, "Firestopping" Annex A.

C. 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.

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 EXISITNG 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.

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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.

C. Section 28 05 00 - REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS. For general electrical requirements, quality assurance, coordination, and project conditions that are common to more than one section in Division 28.

D. 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 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

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 (Contracting Officer Representative)

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 (10 AWG) and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes (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 (10 AWG) and smaller shall be ASTM B1 solid bare copper wire.

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.

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 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 (6 AWG) bonding jumper at all intermediate metallic enclosures and across all section junctions.

3.3 LABELING

A. Comply with requirements in Division 26 Section "ELECTRICAL IDENTIFICATION" Article for instruction signs. The label or its text shall be green.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

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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 the raceway types specified.

1.2 RELATED WORK

A. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. For general electrical requirements, general arrangement of the contract documents, coordination, quality assurance, project conditions, equipment and materials, and items that is common to more than one section of Division 28.

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 QUALITY ASSURANCE

A. Refer to Paragraph 1.4 Quality Assurance, in Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

1.4 SUBMITTALS

A. Submit in accordance with Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY and 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 Resident Engineer/COTR four copies of the certification that the material is in accordance with the drawings and specifications and has been installed.

D. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician, and dated on the date of completion, in accordance with the requirements of Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

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.

H. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints." Include the following:
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified [and the unit will retain its enclosure

characteristics, including its interior accessibility, after the seismic event]."

2. Dimensioned Outline Drawings of Equipment Unit: Identify the center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

I. Source quality-control test reports.

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 (3/4 inch) unless otherwise shown.

2.2.CONDUIT

A. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed (4 inches) and shall be permitted only with cable rated 600 volts or less.

2.3. CONDUIT FITTINGS

A. 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. Set Screw Fittings: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes (2 inches) and smaller. Use set screw type couplings with four set screws each for conduit sizes over (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.

B. Flexible steel conduit fittings:
   1. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
   2. Clamp type, with insulated throat.

C. Expansion and deflection couplings:
   1. Conform to UL 467 and UL 514B.
   2. Accommodate (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, water-tight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.

2.4 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 (1-1/2 by 1-1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than (3/8 inch) diameter steel hanger rods.

D. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

2.5 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.

2.9 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 84 00 "FIRESTOPPING."

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 Resident Engineer/COTR 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 Resident Engineer/COTR 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 as specified in Section 07 84 00, FIRESTOPPING, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

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. 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 (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 (12 inches) of changes of direction, and within (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. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, “FLASHING AND SHEET METAL”.
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 Resident Engineer/COTR.

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”.

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 (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. EMT (Electrical Metallic Tubing). 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. Painting:
   1. Paint exposed conduit as specified in Section09 91 00, “PAINTING”.
   2. Paint all conduits containing cables rated over 600 volts, safety orange. Refer to Section 09 91 00, “PAINTING” for preparation, paint type, and exact color. In addition, paint legends, using (two inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum (20 foot) intervals in between.

3.5 EXPANSION JOINTS

A. Conduits (3 inches) 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 (3 inches) with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce (5 inch) vertical drop midway between the ends. Flexible conduit shall have a green copper ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for (15 inches) and larger conduits are acceptable.
C. Install expansion and deflection couplings where shown.

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 (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 (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 (1/4 inch) bolt size and not less than (1-1/8 inch) embedment.

b. Power set fasteners not less than (1/4 inch) diameter with depth of penetration not less than (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 support 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 (24 inches), center-to-center lateral spacing shall be maintained between boxes).

E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is (4 inches) square by (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 (3/4 inch), but not less than the size shown on the drawings.

C. All conduit ends shall be equipped with insulated bushings.

D. Vertical conduits/sleeves through closets floors shall terminate not less than (3 inches) below the floor and not less than (3 inches) below the ceiling of the floor below.

E. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.

F. 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 Inches
¾	(6)
1	(9)
1-1/4	(14)
1-1/2	(17)
2	(21)
2-1/2	(25)
3	(31)
3-1/2	(36)
4	(45)

G. Furnish and pull wire in all empty conduits. (Sleeves through floor are exceptions).

- - - E N D - - -

SECTION 28 31 00
FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 DESCRIPTION

A. The new fire alarm devices shall connect to the existing fire alarm system manufactured by: Johnson Controls Simplex, the contractor shall program new fire alarm devices onto the existing FACP (Fire Alarm Control Panel). The new fire alarm devices shall be manufactured by Johnson Controls Simplex.

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 (Contracting Officer Representative) or his authorized representative. Installers shall have a minimum of 2 years’ experience installing fire alarm systems.

1.2 SCOPE

A. The new fire alarm devices shall be fully compatible with existing fire alarm system within buildings: 1E, 22 and 28.

B. New fire alarm devices shall be connected to existing fire alarm circuiting (Refer to floor plans for quantity and locations of devices).

C. Existing reused equipment shall be covered as new equipment under the Warranty specified herein.

D. Basic Performance:

1. The signaling line circuits (SLC) between building fire alarm control units shall be wired Style 7 in accordance with NFPA 72.

Isolation shall be provided so that no more than one building can be lost due to a short circuit fault.

2. Signaling line circuits (SLC) within buildings shall be wired Style 4 in accordance with NFPA 72. Individual signaling line circuits shall be limited to covering 22,500 square feet (2,090 square meters) of floor space or 3 floors whichever is less.

1.3 RELATED WORK

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Requirements for procedures for submittals.

B. Section 28 05 00 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. Requirements for general requirements that are common to more than one section in Division 28.

C. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.

D. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.

E. Section 28 05 28.33 - CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.

F. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.

1.4 SUBMITTALS

A. General: Submit 5 copies in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Drawings:

1. Prepare drawings using AutoCAD Release 14 software and include all contractor’s information. Layering shall be by VA criteria as provided by the Contracting Officer’s Technical Representative (COTR). Bid drawing files on AutoCAD will be provided to the Contractor at the pre-construction meeting. The contractor shall be responsible for verifying all critical dimensions shown on the drawings provided by VA.

2. Floor plans: Provide locations of all devices (with device number at each addressable device corresponding to control unit programming), appliances, panels, equipment, junction/terminal cabinets/boxes, risers, electrical power connections, individual circuits and

raceway routing, system zoning; number, size, and type of raceways and conductors in each raceway; conduit fill calculations with cross section area percent fill for each type and size of conductor and raceway. Only those devices connected and incorporated into the final system shall be on these floor plans. Do not show any removed devices on the floor plans. Show all interfaces for all fire safety functions.

3. Riser diagrams: Provide, for the entire system, the number, size and type of riser raceways and conductors in each riser raceway and number of each type of device per floor and zone. Show door holder interface, elevator control interface, HVAC shutdown interface, fire extinguishing system interface, and all other fire safety interfaces. Show wiring Styles on the riser diagram for all circuits. Provide diagrams both on a per building and campus wide basis.
4. Detailed wiring diagrams: Provide for control panels, modules, power supplies, electrical power connections, auxiliary relays and annunciators showing termination identifications, size and type conductors, circuit boards, LED lamps, indicators, adjustable controls, switches, ribbon connectors, wiring harnesses, terminal strips and connectors, spare zones/circuits. Diagrams shall be drawn to a scale sufficient to show spatial relationships between components, enclosures, and equipment configuration.
5. Two weeks prior to final inspection, the Contractor shall deliver to the COR (Contracting Officer Representative) 3 sets of as-built drawings and one set of the as-built drawing computer file (using AutoCAD 2007 or later). As-built drawings (floor plans) shall show all new and/or existing conduit used for the fire alarm system.

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 manufacturers’ 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 printout 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 printout 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 COTR.
   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 WARRANTY

All work performed and all material and equipment furnished under this contract 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.

1.6 GUARANTY PERIOD SERVICES

A. Complete inspection, testing, maintenance, and repair service for the fire alarm system shall be provided by a factory trained authorized

representative of the manufacturer of the major equipment for a period of 5 years from the date of acceptance of the entire installation by the Contracting Officer.

B. Contractor shall provide all necessary test equipment, parts, and labor to perform required inspection, testing, maintenance, and repair.

C. All inspection, testing, maintenance, and permanent records required by NFPA 72, and recommended by the equipment manufacturer, shall be provided by the contractor. Work shall include operation of sprinkler system alarm and supervisory devices as well as all reused existing equipment connected to the fire alarm system. It shall include all interfaced equipment including but not limited to elevators, HVAC shutdown, and extinguishing systems.

D. Maintenance and testing shall be performed in accordance with NFPA 72. A computerized preventive maintenance schedule shall be provided and shall describe the protocol for preventive maintenance of equipment. The schedule shall include a systematic examination, adjustment, and cleaning of all equipment.

E. Non-included Work: Repair service shall not include the performance of any work due to improper use, accidents, or negligence for which the contractor is not responsible.

F. Service and emergency personnel shall report to the Engineering Office or their authorized representative upon arrival at the hospital and again upon the completion of the required work. A copy of the work ticket containing a complete description of the work performed and parts replaced shall be provided to the VA COR (Contracting Officer Representative) or his authorized representative.

G. Emergency Service:

1. Warranty Period Service: Service other than the preventative maintenance, inspection, and testing required by NFPA 72 shall be considered emergency call-back service and covered under the warranty of the installation during the first year of the warranty period, unless the required service is a result of abuse or misuse by the Government. Written notification shall not be required for emergency warranty period service and the contractor shall respond as outlined in the following sections on Normal and Overtime Emergency Call-Back Service. Warranty period service can be required during normal or overtime emergency call-back service time periods

at the discretion of the COR (Contracting Officer Representative) or his authorized representative.

2. Normal and overtime emergency call-back service shall consist of an on-site response within 2 hours of notification of a system trouble.
3. Normal emergency call-back service times are between the hours of 7:30 a.m. and 4:00 p.m., Monday through Friday, exclusive of federal holidays. Service performed during all other times shall be considered to be overtime emergency call-back service. The cost of all normal emergency call-back service for years 2 through 5 shall be included in the cost of this contract.
4. Overtime emergency callback service shall be provided for the system when requested by the Government. The cost of the first 40 person-hours per year of overtime call-back service during years 2 through 5 of this contract shall be provided under this contract. Payment for overtime emergency call-back service in excess of the 40-man hours per year requirement will be handled through separate purchase orders. The method of calculating overtime emergency call-back hours is based on actual time spent on site and does not include travel time.

H. The contractor shall maintain a log at each fire alarm control unit. The log shall list the date and time of all examinations and trouble calls, condition of the system, and name of the technician. Each trouble call shall be fully described, including the nature of the trouble, necessary correction performed, and parts replaced.

1.7 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 A- 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 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. 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.
3. 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 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 (Contracting Officer Representative).

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, and all penetrations of smoke and fire barriers shall be protected as required by Section 07 84 00, FIRESTOPPING.

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 in accordance with Section 09 91 00, PAINTING to match finished surrounding areas and red in unfinished areas.

D. All fire detection and alarm system devices 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 (Contracting Officer Representative).

E. Mount valve tamper switches so as not to interfere with the normal operation of the valve and adjust to operate within 2 revolutions toward the closed position of the valve control, or when the stem has moved no more than 1/5 of the distance from its normal position.

3.2 TYPICAL OPERATION

1.

A. Heat detectors in elevator machine rooms shall, in addition to the above functions, disconnect all power to all elevators served by that machine room after a time delay. The time delay shall be programmed within the fire alarm system programming and be equal to the time it takes for the car to travel from the highest to the lowest level, plus 10 seconds.

D. Smoke detectors in the remaining elevator lobbies, elevator machine room, or top of hoist way shall, in addition to the above functions, return all elevators in the bank to the primary floor.

3.3 TESTS

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 for the system. Make all adjustments and tests in the presence of the COTR.

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 COTR. 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 (Contracting Officer Representative) 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.

3.4 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.

J

- - END - -

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July 15, 2022

TTL Project No. 2260101

Department of Veterans Affairs
VA Ann Arbor Healthcare System
2215 Fuller Road
Ann Arbor, Michigan 48105

The attached Asbestos Survey and Assessment report has been prepared for the Veterans Affairs (VA) Ann Arbor Medical Center located at 2215 Fuller Road, Ann Arbor, Michigan. The reassessment was conducted by TTL Associates, Inc. (TTL) during the week of June 20, 2022 by State of Michigan accredited building inspectors Mr. Harjot Singh (A33562) and Mr. Rob Serlin (A36417). The buildings covered in this updated survey are:

Building #	Year Built	Building Name	Total Gross Square Foot
1W	1953	Main Hospital & Additions	449,693
2	1942	Day Care Center & 1993 Addition	4,420
3	1953	Administrative Offices	8,673
22	1971	Research Building & 1988 Addition	17,630
28	1985	Extended Care Center	58,900

The VA Ann Arbor Healthcare System occupies all of these buildings.

PURPOSE AND SCOPE OF WORK

Under a VA mandate, the asbestos survey needs to be updated every three years. The asbestos building inspectors were briefed on the scope of the project by Mr. Joe Jurasek – VA Ann Arbor Medical Center Safety Services. The purpose of this reinspection was to verify which of the previously identified asbestos-containing materials (ACM) were still present and to verify the quantity and condition of the materials. All of the previously identified rooms/spaces were to be examined, as well as areas where asbestos abatement had occurred to verify the completeness of the abatement.

No new suspect materials were identified during this asbestos reassessment. There have been room number changes that are noted in the comments section and the new room numbers are used in the ACM room inventory log.

There have been renovation projects at the facility in the last three years in which quantities of ACM were removed as well as routine maintenance activities where a fitting or two have been removed.

Since the majority of the thermal system insulation (TSI) is found above ceilings or other relatively inaccessible areas, disturbance of TSI by medical staff, patients and visitors is unlikely. The limited asbestos-containing sprayed-on insulation located on some structural beams on the 8th floor, North Wing of the Main Hospital, is above ceiling tiles. Care needs to be exercised when working above these areas. When lifting ceiling tiles in areas where debris is noted or in the area of the sprayed-on insulation, precautions need to be taken to prevent further disturbance of the accumulated ACM debris.

Floor tiles that contain asbestos are found throughout the hospital in patient rooms, corridors, treatment rooms, offices, storage areas and closets. All but the offices and storage areas see fairly heavy traffic; in all cases the flooring is in good condition. Maintenance personnel should follow the requirements for floor maintenance outlined in occupational safety and health administration (OSHA) revised asbestos regulations, Title 29 of the code of federal register (CFR) 1926.1101(l)(3). Additional requirements under environmental protection agency (EPA) national emission standard for hazardous air pollutants (NESHAP) and OSHA need to be followed if/when floor coverings are removed during building renovation or demolition.

Physical Assessment Considerations

The standard asbestos hazard emergency response act (AHERA) Assessment Categories (40 CFR 763.88(b)) were used as follows:

1. Damaged or significantly damaged thermal system insulation ACM.
2. Damaged friable surfacing ACM.
3. Significantly damaged friable surfacing ACM.
4. Damaged or significantly damaged friable miscellaneous ACM.
5. ACBM with potential for damage.
6. ACBM with potential for significant damage.
7. Any remaining friable ACBM or friable suspected ACBM.

ACM Debris: ACM debris is still present on the back surfaces of ceiling tiles in several areas and is listed in the Room Inventory Log. In Bldg. 1W, second floor, the area was given a higher response category due to high air movement within the ceiling plenum. Areas with debris should be cleaned up using the requirements of OSHA 29 CFR 1926.1101 (l) (4).

Thermal system insulation (TSI): TSI is in good condition overall. Areas with damage have been noted in the Room Inventory Log in the comments section and assigned a higher response category. Remediation of these areas is recommended. All ACM TSI should be included in the VA Ann Arbor Medical Center operations and maintenance (O&M) Program.

Surfacing Materials (SM): Sprayed-on ACM was observed on the 8th floor North Wing of the Main Hospital and is applied on structural beams located above ceiling tiles. There are four separate areas and in some cases the beam has been enclosed in drywall. There is also sprayed-on insulation visible in the pipe chase in the Penthouse of Building 22. The plaster in Building 3 is in good condition with one area showing signs of damage. These areas need to be included in the owner's O & M Program.

Floor Coverings and Mastics: All floor covering is in good condition. Any damaged tiles have been sealed with floor wax. Flooring materials were found to be non-friable in the inspected areas of the VA Ann Arbor Medical Center. Maintenance and housekeeping personnel need to be informed where these tiles are located and follow the floor care procedures outlined in asbestos regulations as stated above.

Transite: These materials are in good condition and considered non-friable. Prior to any renovation projects that would impact these materials or demolition of the building these materials need to be removed.

RECOMMENDED RESPONSE ACTION

Response Categories were assigned to each asbestos-containing homogeneous area from the following:

1. Significantly damaged ACM; exposed, friable ACM; ACM that has been or is likely to be disturbed and/or damaged, resulting in an exposure hazard to maintenance/service workers, and/or hospital staff and patients in the area. There was only one category one area and that is a riser in the Building 1W Room BB55 that is blocked by a book shelf.

2. Damaged ACM in areas with limited access above ceilings, behind access panels, in pipe chases or accessible only to maintenance and service personnel. Category 2 materials should be repaired and/or removed as soon as possible. If repaired and left in place, these materials should be included in periodic re-inspections to assess their condition. There are several areas that are category 2 located above ceiling tiles and some damaged TSI in the sub-basement area.

The category 2 areas above ceiling tiles are the following rooms:

Bldg. 1W 2nd Floor	Room B274
Bldg. 1W 8th Floor	Room A839 and A844
Bldg. 1W 9th Floor	Corridor C902 near A925, A929 And A938
Bldg. 3 Basement	Room 01
Bldg. 22 Penthouse	Sprayed-on Insulation in Pipe Chase

3. TSI with intact coverings located in inaccessible areas or mechanical rooms. Category 3 materials should be re-inspected periodically to assess their condition and abated or repaired as changes in condition warrants.

4. Floor tiles and linoleum in offices, patient rooms, laboratories/workshops, storage areas and corridors. Category 4 materials need not be removed or abated. OSHA/EPA requirements for maintenance should be followed. There are some areas where there is newer floor tile or carpeting where it could not be confirmed that the previously identified asbestos-containing floor tile and/or mastic have been removed.

5. Other ACM that are generally in good condition. These materials need to be addressed prior to renovation or demolition projects that would disturb them.

Based on this asbestos assessment report, there are areas where clean-up of ACM is recommended as well as patch and repair of damaged TSI and SM. This will require the use of a licensed abatement contractor using trained and accredited personnel or the owner's personnel who have been trained in OSHA Class III operations for custodial workers in accordance with 40 CFR Part 763.92 (a)(2). All asbestos abatement work needs to follow OSHA's work practices and control methods mandated for the appropriate class of work. Additional requirements such as air monitoring and notifications may also be applicable depending on the response action.

APPENDICES

HOMOGENEOUS AREA LISTS

The suspect ACM are listed and described along with a separate tab for the positive homogeneous areas (HA).

SAMPLE LOCATOR

Sample log of suspect materials that were sampled and analyzed for asbestos from the original survey to the previous assessment. No samples were collected during the 2019 reinspection.

ROOM INVENTORY LOGS

On the pages that follow, the reader will find the inspection data in detail organized by functional area.

Explanation of items and abbreviations used on the Room Inventory Log follows.

- Bldg./Floor/Room No. - VA Building Number, Floor number, and the room number found on the outside of the door. Within the Main Hospital the A designation notates room in the East-West Wings, the B prefix is for areas within the North Wing of the Hospital and C notates corridors.

- Homogeneous Area Description - This column provides the number and description of the material, which will consider such factors as size, application and color. The number and description under the heading correspond to the Homogeneous Area List.

- Materials Type - This identifies the specific ACM by type. Wiring material is classified as a miscellaneous material (MM) and non-friable category II.

- Location – Where in the room/space the ACM is located.

- Quantity - This will have the quantity of ACM in the room/space in which the ACM is present.

- Unit - The type of measurement used to quantify the material.

- Response Category – See the definition or basis for the assignment as listed above.

- AHERA Assess Category - AHERA Assessment Categories.

- Comments - Any useful remarks.

A separate room inventory is included with estimated asbestos abatement pricing. Abatement pricing is based on individual response to remove the ACM except in the case of the floor tile and mastic. Some of the items are rather high and savings can be realized by grouping items together especially if they are in close proximity. Included in the unit prices is disposal but not the air monitoring services. Generally daily air monitoring for phase contrast microscopy (PCM) analysis is in the range of $650 - $850 for an eight-hour day.

INSPECTOR CREDENTIALS

Also included in this report are copies of the State of Michigan accreditations of the inspectors utilized on the project.

LIMITATIONS

This report was prepared with the asbestos policy of the VA, the best professional practice of asbestos inspections and applicable regulations. This report reflects the location, current condition and quantity of ACM and the location and quantity of asbestos contaminated elements (ACE) in the areas that could be accessed without destructive methods at the time of the survey and assessment. The assessment of ACM and ACE in areas that could not be accessed without structural damage have been noted based on previous reassessments and available information and data.

TTL appreciates the opportunity to provide the VA Ann Arbor Healthcare System with our environmental consulting and testing services and we look forward to working with you in the future. Should you have any questions concerning this report, please contact Mr. Harjot Singh at (419) 214-5058.

Sincerely,

TTL Associates, Inc.

Harjot Singh

Harjot Singh
Asbestos Inspector

Tony Finch

Tony Finch, CPG
Senior Project Manager

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Bldg.	Floor	Room No	HA	Material Type	Homogeneous Area Description	Location	Qty	Unit	Response Category	AHERA Assessment	NESHAP Category	Comments
1W	SB	Open area	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	at ceiling	5	FTG	3	5	RACM	Access at Bottom of Staircase 4
1W	SB	Open area	26	TSI/Friable	Mudded pipe fittings on steam lines; >2", <6" diameter pipes	at ceiling	11	FTG	2	1	RACM	
1W	SB	Open area	69	TSI/Friable	Mudded pipe fittings on millboard - insulated lines <2"	at ceiling	5	FTG	3	5	RACM	
1W	SB	Open area	70	TSI/Friable	Straight run millboard insulation <2" diameter pipes	at ceiling	170	LF	3	5	RACM	
1W	Basement	AB00	134	TSI/Friable	Drain fittings <2" - >6" diameter	above ceiling	2	FTG	3	5	RACM	
1W	Basement	AB02	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	1085	SF	4		Cat. I	Rooms AB02, AB04 & AB06 Combined
1W	Basement	AB02	3	MM/Non-Friable	Mastic under HA # 1	floor	1085	SF	4		Cat. I	Rooms AB02, AB04 & AB06 Combined
1W	Basement	AB02	6	TSI/Friable	Mudded pipe fittings on steam lines; <2" diameter pipes	chase	6	FTG	3	5	RACM	Rooms AB02, AB04 & AB06 Combined
1W	Basement	AB02	7	MM/Non-Friable	1' x 1' Floor tile; Tan with brown and white streaks	floor	605	SF	4		Cat. I	Rooms AB02, AB04 & AB06 Combined
1W	Basement	AB02	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	chase	6	FTG	3	5	RACM	Rooms AB02, AB04 & AB06 Combined
1W	Basement	AB05	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	194	SF	4	5	Cat. I	1 Tile Chipped at Entrance
1W	Basement	AB05	3	MM/Non-Friable	Mastic under HA # 1	floor	194	SF	4		Cat. I	
1W	Basement	AB07	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	50	SF	4		Cat. I	
1W	Basement	AB07	3	MM/Non-Friable	Mastic under HA # 1	floor	50	SF	4		Cat. I	
1W	Basement	AB23	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	830	SF	4		Cat. I	
1W	Basement	AB23	3	MM/Non-Friable	Mastic under HA # 1	floor	830	SF	4		Cat. I	
1W	Basement	AB31	9	TSI/Friable	Insulation on domestic pipe straight runs; <2" diameter	at ceiling	15	LF	3	5	RACM	

Bldg.	Floor	Room No	HA	Material Type	Homogeneous Area Description	Location	Qty	Unit	Response Category	AHERA Assessment	NESHAP Category	Comments
1W	Basement	AB31	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	at ceiling	4	FTG	3	5	RACM	1 Damaged
1W	Basement	AB31	285	TSI/Friable	Straight run millboard insulation 2" - 6" diameter pipes	at ceiling	20	LF	3	5	RACM	
1W	Basement	AB45	9	TSI/Friable	Insulation on domestic pipe straight runs; <2" diameter	ceiling	5	LF	3	5	RACM	
1W	Basement	AB45	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	ceiling	2	FTG	3	5	RACM	
1W	Basement	BB02	285	TSI/Friable	Straight run millboard insulation 2" - 6" diameter pipes	riser at wall and near ceiling	5	LF	3	5	RACM	
1W	Basement	BB43	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	96	SF	4		Cat. I	
1W	Basement	BB43	3	MM/Non-Friable	Mastic under HA # 1	floor	96	SF	4		Cat. I	
1W	Basement	BB44	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	376	SF	4		Cat. I	
1W	Basement	BB44	3	MM/Non-Friable	Mastic under HA # 1	floor	376	SF	4		Cat. I	
1W	Basement	BB50	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	above ceiling	5	FTG	3	5	RACM	
1W	Basement	BB50	70	TSI/Friable	Straight run millboard insulation <2" diameter pipes	above ceiling	20	LF	3	5	RACM	
1W	Basement	BB53	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	above ceiling	3	FTG	3	5	RACM	
1W	Basement	BB53	70	TSI/Friable	Straight run millboard insulation; <2" diameter pipes	above ceiling	4	LF	3	5	RACM	
1W	Basement	BB54	70	TSI/Friable	Straight run millboard insulation; <2" diameter pipes	above ceiling	9	LF	3	5	RACM	
1W	Basement	BB55	69	TSI/Friable	Mudded pipe fittings on millboard - insulated lines <2"	riser	1	FTG	3	5	RACM	
1W	Basement	BB55	70	TSI/Friable	Straight run millboard insulation <2" diameter pipes	riser	10	LF	1	1	RACM	Blocked with Shelving
1W	Basement	BB56	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	75	SF	4		Cat. I	
1W	Basement	BB56	3	MM/Non-Friable	Mastic under HA # 1	floor	75	SF	4		Cat. I	
1W	Basement	BB56	9	TSI/Friable	Insulation on domestic pipe straight runs; <2" diameter	above ceiling	10	LF	3	5	RACM	

Bldg.	Floor	Room No	HA	Material Type	Homogeneous Area Description	Location	Qty	Unit	Response Category	AHERA Assessment	NESHAP Category	Comments
1W	Basement	BB56	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	above ceiling	6	FTG	3	5	RACM	
1W	Basement	BB57	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	225	SF	4		Cat. I	
1W	Basement	BB57	3	MM/Non-Friable	Mastic under HA # 1	floor	225	SF	4		Cat. I	
1W	Basement	BB57	70	TSI/Friable	Straight run millboard insulation <2" diameter pipes		4	LF	3	5	RACM	
1W	Basement	BB57	286	TSI/Friable	Mudded pipe fittings on millboard - insulated lines 2" - 6" diameter pipes		1	FTG	3	5	RACM	
1W	Basement	BB77	6	TSI/Friable	Mudded pipe fittings on steam lines; <2" diameter pipes	East end of closet	8	FTG	3	5	RACM	Closet off of BB77
1W	Basement	BB77	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	above ceiling	6	FTG	3	5	RACM	
1W	Basement	BB77	26	TSI/Friable	Mudded pipe fittings on steam lines; >2", <6" diameter pipes	riser	2	FTG	3	5	RACM	Closet off of BB77
1W	Basement	BB79	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	above ceiling	10	FTG	3	5	RACM	
1W	Basement	BB79	65	MM/Non-Friable	2' x 2' Wall panels with regular-spaced holes	wall	480	SF	5	5	Cat. II	1 Damaged Panel still remains
1W	Basement	BB79	181	MM/Non-Friable	1' x 1' Floor tile; Olive with brown and white flecks	floor	210	SF	4		Cat. I	
1W	Basement	BB79	182	MM/Non-Friable	Mastic under HA # 181	floor	210	SF	4		Cat. I	
1W	Basement	C - BB06	69	TSI/Friable	Mudded pipe fittings on millboard-insulated lines <2" diameter	above ceiling	4	FTG	1	1	RACM	Corridor BB06 on Print Near Corridor BB01
1W	Basement	C - BB06	70	TSI/Friable	Straight run millboard insulation <2" diameter pipes	above ceiling	60	LF	3	5	RACM	Corridor BB06 on Print Near Corridor BB01
1W	Basement	C - BB06	70	TSI/Friable	Straight run millboard insulation <2" diameter pipes	pipe chase	24	LF	3	5	RACM	Corridor BB06 on Print - In Pipe Chases
1W	Basement	Corridor C4	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	1050	SF	4		Cat. I	Former Corridor 1117
1W	Basement	Corridor C4	3	MM/Non-Friable	Mastic under HA # 1	floor	1050	SF	4		Cat. I	Former Corridor 1117
1W												
1W	1	A142	70	TSI/Friable	Straight run millboard insulation <2" diameter pipes	Pipe chase next to room A125	24	LF	3	5	RACM	Blocked off, Can be seen from A125
1W	1	B139	13	MM/Non-Friable	9" x 9" Floor tile; Olive with brown and white streaks	floor	35	SF	4		Cat. I	

Bldg.	Floor	Room No	HA	Material Type	Homogeneous Area Description	Location	Qty	Unit	Response Category	AHERA Assessment	NESHAP Category	Comments
1W	1	B139	16	MM/Non-Friable	Mastic under HA # 13	floor	35	SF	4		Cat. I	
1W	1	B139	119	MM/Non-Friable	9' x 9' Floor tile; Red with cream streaks	floor	9	SF	4		Cat. I	
1W	1	B139	120	MM/Non-Friable	Mastic under HA # 119	floor	9	SF	4		Cat. I	
1W	1	B180	70	TSI/Friable	Straight run millboard insulation; <2" diameter pipes	above ceiling	18	LF	3	5	RACM	
1W	1	B184	69	TSI/Friable	Mudded pipe fittings on millboard - insulated lines <2"	above ceiling	2	FTG	3	5	RACM	Vestibule, Could Not Access Ceiling
1W												
1W	2	B270	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	pipe chase	2	FTG	3	5	RACM	
1W	2	B272	6	TSI/Friable	Insulation on mud steam fittings; <2" diameter pipes	above ceiling	6	FTG	3	5	RACM	
1W	2	B274	44	TSI/Friable	LPS straight runs on pipes <2" diameter	above ceiling	35	LF	2	1	RACM	10 LF Damaged
1W	2	B274	70	TSI/Friable	Straight run millboard insulation <2" diameter pipes	above ceiling	6	LF	2	1	RACM	2 Fittings Damaged
1W	2	B274	134	TSI/Friable	Drain fittings >2" - <6" diameter	above ceiling	3	FTG	3	5	RACM	
1W	2	B276	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	above ceiling	8	FTG	2	1	RACM	
1W	2	B276	69	TSI/Friable	Mudded pipe fittings on millboard - insulated lines <2"	above ceiling	4	FTG	3	5	RACM	
1W	2	B276	70	TSI/Friable	Straight run millboard insulation <2" diameter pipes	above ceiling	10	LF	3	5	RACM	
1W	2	B278	6	TSI/Friable	Mudded pipe fittings on steam lines; <2" diameter pipes	above ceiling	8	FTG	3	5	RACM	
1W	2	B279	6	TSI/Friable	Mudded pipe fittings on steam lines; <2" diameter pipes	above ceiling	8	FTG	3	5	RACM	Previously B277a
1W	2	B279	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	above ceiling	2	FTG	3	5	RACM	Previously B277a
1W	2	B279	71	TSI/Friable	Mag insulation on <2" diameter pipes	above ceiling	25	LF	3	5	RACM	
1W	2	B280a	100	TSI/Friable	Mag-insulated pipes and fittings >2" - <6" diameter	above ceiling	10	FTG	3	5	RACM	Inaccessible from B280a Can be seen from B278
1W	2	C209	69	TSI/Friable	Mudded pipe fittings on millboard - insulated lines <2"	above ceiling	2	FTG	3	5	RACM	
1W	2	C209	71	TSI/Friable	Mag insulation on <2" diameter pipes	above ceiling	84	LF	3	5	RACM	
1W	2	C209	100	TSI/Friable	Mag-insulated pipes and fittings >2" - <6" diameter	above ceiling	20	LF	3	5	RACM	
1W												

Bldg.	Floor	Room No	HA	Material Type	Homogeneous Area Description	Location	Qty	Unit	Response Category	AHERA Assessment	NESHAP Category	Comments
1W	7	B716	70	TSI/Friable	Straight run millboard insulation; <2" diameter pipes	above ceiling	2	LF	3	5	RACM	
1W	7	B718	69	TSI/Friable	Mudded pipe fittings on millboard - insulated lines <2"	above ceiling	2	FTG	3	5	RACM	Screwed Shut - No Access
1W	7	B718	70	TSI/Friable	Straight run millboard insulation; <2" diameter pipes	above ceiling	24	LF	3	5	RACM	Screwed Shut - No Access
1W	7	B719	246	MM/Non-Friable	Pink sink undercoating	sink cabinet	8	SF	5	5	Cat. II	Screwed Shut - No Access
1W	7	B732a	285	TSI/Friable	Straight run millboard insulation 2" - 6" diameter pipes	above ceiling	10	LF	3	5	RACM	Plaster Ceiling - Viewed from B732
1W	7	B732a	286	TSI/Friable	Mudded pipe fittings on millboard - insulated lines 2" - 6" diameter pipes	above ceiling	1	FTG	3	5	RACM	Plaster Ceiling - Viewed from B732
1W	7	B737	177	TSI/Friable	Chrysotile duct and insulation	above ceiling	24	SF	3	5	RACM	
1W	7	B737	177	TSI/Friable	Chrysotile duct and insulation	chase	32	SF	3	5	RACM	
1W	7	C706	69	TSI/Friable	Mudded pipe fittings on millboard insulated lines; <2" diameter pipes	above ceiling	4	FTG	3	5	RACM	Near Rooms B719 - B721
1W	7	C706	285	TSI/Friable	Straight run millboard insulation 2" - 6" diameter pipes	above ceiling	24	LF	3	5	RACM	2 Lines, Near Rooms B719 - B721
1W												
1W	8	A848	237	MM/Non-Friable	Transite panel/board material	wall register	24	SF	5		Cat. II	
1W	8	A848	238	MM/Non-Friable	Brown fibrous board material	wall register	24	SF	5	5	Cat. II	
1W	8	A851	237	MM/Non-Friable	Transite panel/board material	wall register	24	SF	5		Cat. II	
1W	8	A851	238	MM/Non-Friable	Brown fibrous board material	wall register	24	SF	5	5	Cat. II	
1W	8	A851a	242	MM/Non-Friable	White sink undercoating	sink cabinet	4	SF	5	5	Cat. II	
1W	8	A851c	237	MM/Non-Friable	Transite panel/board material	wall register	24	SF	5		Cat. II	
1W	8	A851c	238	MM/Non-Friable	Brown fibrous board material	wall register	24	SF	5	5	Cat. II	
1W	8	A851j	237	MM/Non-Friable	Transite panel/board material	wall register	48	SF	5		Cat. II	
1W	8	A851j	238	MM/Non-Friable	Brown fibrous board material	wall register	48	SF	5	5	Cat. II	
1W	8	A851l	237	MM/Non-Friable	Transite panel/board material	wall register	24	SF	5		Cat. II	

Bldg.	Floor	Room No	HA	Material Type	Homogeneous Area Description	Location	Qty	Unit	Response Category	AHERA Assessment	NESHAP Category	Comments
1W	8	A8511	238	MM/Non-Friable	Brown fibrous board material	wall register	24	SF	5	5	Cat. II	
1W	8	A853	181	MM/Non-Friable	1' x 1' Floor tile; Olive with brown and white flecks	floor	37	SF	4		Cat. I	
1W	8	A853	182	MM/Non-Friable	Mastic under HA # 181	floor	37	SF	4		Cat. I	
1W	8	A854	184	MM/Non-Friable	1' x 1' Floor tile; Olive with green and white streaks	floor	129	SF	4		Cat. I	
1W	8	A854	185	MM/Non-Friable	Mastic under HA # 184	floor	129	SF	4		Cat. I	
1W	8	A854	237	MM/Non-Friable	Transite panel/board material	wall register	24	SF	5		Cat. II	
1W	8	A854	238	MM/Non-Friable	Brown fibrous board material	wall register	24	SF	5	5	Cat. II	
1W	8	A855	6	TSI/Friable	Mudded pipe fittings on steam lines; <2" diameter pipes	above ceiling	6	FTG	3	5	RACM	Assumed - No access above ceiling
1W	8	A855	184	MM/Non-Friable	1' x 1' Floor tile; Olive with green and white streaks	floor	145	SF	4		Cat. I	
1W	8	A855	185	MM/Non-Friable	Mastic under HA # 184	floor	145	SF	4		Cat. I	
1W	8	A855	237	MM/Non-Friable	Transite panel/board material	wall register	24	SF	5		Cat. II	
1W	8	A855	238	MM/Non-Friable	Brown fibrous board material	wall register	24	SF	5	5	Cat. II	
1W	8	A855	283	MM/Non-Friable	Glue pods on 1' x 1' ceiling tile	ceiling	146	SF	5	5	Cat. II	
1W	8	C - B820	71	TSI/Friable	Mag insulation on <2" diameter pipes	above ceiling	40	LF	3	5	RACM	Corridor B820 on Print by Rooms S-12 - A831, 2 Lines Near B831a
1W	8	C - B820	285	TSI/Friable	Straight run millboard insulation 2" - 6" diameter pipes	above ceiling	4	LF	3	5	RACM	Corridor B820 on Print by Rooms S-12 - A831, Near Room 831a
1W	8	C803	69	TSI/Friable	Mudded pipe fittings on millboard-insulated lines; <2" diameter pipes	above ceiling	4	FTG	3	5	RACM	Corridor C803 By Room B827B
1W	8	C803	70	TSI/Friable	Straight run millboard insulation; <2" diameter pipes	above ceiling	5	LF	3	5	RACM	Corridor C803 By Room B827B
1W	8	C804	69	TSI/Friable	Mudded pipe fittings on millboard - insulated lines <2"	above ceiling	17	FTG	4	1	RACM	
1W												

Bldg.	Floor	Room No	HA	Material Type	Homogeneous Area Description	Location	Qty	Unit	Response Category	AHERA Assessment	NESHAP Category	Comments
1W	9	A905	181	MM/Non-Friable	1' x 1' Floor tile; Olive with brown and white flecks	floor	45	SF	4		Cat. I	Labeled A906 on Print, 905 on Door - No Access
1W	9	A905	182	MM/Non-Friable	Mastic under HA # 181	floor	45	SF	4		Cat. I	Labeled A906 on Print, 905 on Door - No Access
1W	9	A919	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	above ceiling	2	FTG	3	5	RACM	Assumed - Limited access
1W	9	A925	237	MM/Non-Friable	Transite panel/board material	wall register	8	SF	5		Cat. II	Stairway #5
1W	9	A925	238	MM/Non-Friable	Brown fibrous board material	wall register	8	SF	5	5	Cat. II	Stairway #5
1W	9	A926	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" diameter pipes	above ceiling	3	FTG	3	5	RACM	
1W	9	A926	285	TSI/Friable	Straight run millboard insulation 2" - 6" diameter pipes	above ceiling	46	LF	3	5	RACM	
1W	9	A926	286	TSI/Friable	Mudded pipe fittings on millboard - insulated lines 2" - 6" diameter pipes	above ceiling	9	FTG	3	5	RACM	
1W	9	A926c	69	TSI/Friable	Mudded pipe fittings on millboard-insulated lines; <2" diameter pipes	above ceiling	2	FTG	3	5	RACM	Plaster Ceiling
1W	9	A926c	70	TSI/Friable	Straight run millboard insulation; <2" diameter pipes	above ceiling	2	LF	3	5	RACM	Plaster Ceiling
1W	9	A926d	70	TSI/Friable	Straight run millboard insulation; <2" diameter pipes	above ceiling	6	LF	3	5	RACM	Plaster Ceiling
1W	9	A929	13	MM/Non-Friable	9" x 9" Floor tile; Olive with brown and white streaks	floor	120	SF	4		Cat. I	Under new Carpet
1W	9	A929	16	MM/Non-Friable	Mastic under HA # 13	floor	120	SF	4		Cat. I	Under new Carpet
1W	9	A929a	13	MM/Non-Friable	9" x 9" Floor tile; Olive with brown and white streaks	floor	15	SF	4		Cat. I	
1W	9	A929a	16	MM/Non-Friable	Mastic under HA # 13	floor	15	SF	4		Cat. I	
1W	9	A930	13	MM/Non-Friable	9" x 9" Floor tile; Olive with brown and white streaks	floor	120	SF	4		Cat. I	Under new Carpet
1W	9	A930	16	MM/Non-Friable	Mastic under HA # 13	floor	120	SF	4		Cat. I	Under new Carpet
1W	9	A931	13	MM/Non-Friable	9" x 9" Floor tile; Olive with brown and white streaks	floor	121	SF	4		Cat. I	Under new Carpet
1W	9	A931	16	MM/Non-Friable	Mastic under HA # 13	floor	121	SF	4		Cat. I	Under new Carpet
1W	9	A932	69	TSI/Friable	Mudded pipe fittings on millboard-insulated lines; <2" diameter pipes	above ceiling	2	FTG	3	5	RACM	No Access - Visible from 931

Bldg.	Floor	Room No	HA	Material Type	Homogeneous Area Description	Location	Qty	Unit	Response Category	AHERA Assessment	NESHAP Category	Comments
1W	9	A932	70	TSI/Friable	Straight run millboard insulation; <2" diameter pipes	above ceiling	17	LF	3	5	RACM	No Access - Visible from 931
1W	9	A932	283	MM/Non-Friable	Glue pods on 1' x 1' ceiling tile	ceiling	115	SF	5	5	Cat. II	No access panels
1W	9	A933	70	TSI/Friable	Straight run millboard insulation; <2" diameter pipes	above ceiling	22	LF	3	5	RACM	
1W	9	A934	70	TSI/Friable	Straight run millboard insulation; <2" diameter pipes	above ceiling	20	LF	3	5	RACM	
1W	9	A935	285	TSI/Friable	Straight run millboard insulation 2" - 6" diameter pipes	above ceiling	20	LF	3	5	RACM	
1W	9	FEC	13	MM/Non-Friable	9" x 9" Floor tile; Olive with brown and white streaks	floor	4	SF	4		Cat. I	FEC Room next to A905 - No Access
1W	9	FEC	16	MM/Non-Friable	Mastic under HA # 13	floor	4	SF	4		Cat. I	FEC Room next to A905 - No Access
1W	9	C902	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" diameter pipes	above ceiling	37	FTG	2	1	RACM	2 Damaged - Near A925 and A938
1W	9	C902	26	TSI/Friable	Mudded pipe fittings on steam lines; >2", <6" diameter pipes	above ceiling	8	FTG	3	5	RACM	
1W	9	C902	69	TSI/Friable	Mudded pipe fittings on millboard-insulated lines; <2" diameter pipes	above ceiling	4	FTG	2	1	RACM	1 Damaged Near A929
1W	9	C902	70	TSI/Friable	Straight run millboard insulation; <2" diameter pipes	above ceiling	12	LF	3	5	RACM	
1W	9	C902	285	TSI/Friable	Straight run millboard insulation 2" - 6" diameter pipes	above ceiling	224	LF	2	1	RACM	
1W	9	C902	286	TSI/Friable	Mudded pipe fittings on millboard - insulated lines 2" - 6" diameter pipes	above ceiling	28	FTG	2	1	RACM	
1W												
1W	10	Elevator Penthouse	254	MM/Non-Friable	Elevator brake pads	electrical	12	PADS	5		Cat. II	2 SF EACH (ASSUMED)

Bldg.	Floor	Room No	HA	Material Type	Homogeneous Area Description	Location	Qty	Unit	Response Category	AHERA Assessment	NESHAP Category	Comments
2	Basement	Laundry Room	69	TSI/Friable	Mudded pipe fittings on millboard-insulated lines; <2" diameter pipes	at ceiling	1	FTG	3	5	RACM	
2	Basement	Laundry Room	70	TSI/Friable	Straight run millboard insulation; <2" diameter pipes	at ceiling	45	LF	3	5	RACM	

Bldg.	Floor	Room No	HA	Material Type	Homogeneous Area Description	Location	Qty	Unit	Response Category	AHERA Assessment	NESHAP Category	Comments
3	Basement	01	9	TSI/Friable	Insulation on domestic pipe straight runs; <2" diameter	above ceiling	14	LF	3	5	RACM	
3	Basement	01	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	above ceiling	10	FTG	3	5	RACM	1 Damaged
3	Basement	01a	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	375	SF	4		Cat. I	
3	Basement	01a	3	MM/Non-Friable	Mastic under HA # 1	floor	375	SF	4		Cat. I	
3	Basement	01b	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	above ceiling	15	FTG	2	1	RACM	1 Damaged
3	Basement	03	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	above ceiling	2	FTG	3	5	RACM	
3	Basement	03c	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	above ceiling	5	FTG	3	5	RACM	
3	Basement	03d	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	above ceiling	8	FTG	3	5	RACM	
3	Basement	04	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	96	SF	4		Cat. I	Stair #2, SE Corner of Bldg.
3	Basement	04	3	MM/Non-Friable	Mastic under HA # 1	floor	96	SF	4		Cat. I	Stair #2, SE Corner of Bldg.
3	Basement	04	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	above ceiling	2	FTG	3	5	RACM	
3	Basement	Corridor	18	TSI/Friable	Mudded pipe fittings on domestic water lines; <2" dia. Pipes	above ceiling	1	FTG	3	5	RACM	By Room 03
3	1	101	276	SM/Friable	Wall plaster	outer wall of room	216	SF	5	5	RACM	
3	1	101a	276	SM/Friable	Wall plaster	outer wall of room	104	SF	5	5	RACM	
3	1	101b	276	SM/Friable	Wall plaster	outer wall of room	220	SF	5	5	RACM	
3	1	101c	276	SM/Friable	Wall plaster	outer wall of room	64	SF	5	5	RACM	
3	1	101d	276	SM/Friable	Wall plaster	outer wall of room	88	SF	5	3	RACM	
3	1	103	276	SM/Friable	Wall plaster	outer wall of room	88	SF	5	5	RACM	Women's Bathroom
3	1	104	276	SM/Friable	Wall plaster	outer wall of room	88	SF	5	5	RACM	Men's Bathroom
3	1	105	276	SM/Friable	Wall plaster	outer wall of room	72	SF	5	5	RACM	Behind Drywall

Bldg.	Floor	Room No	HA	Material Type	Homogeneous Area Description	Location	Qty	Unit	Response Category	AHERA Assessment	NESHAP Category	Comments
3	1	106	276	SM/Friable	Wall plaster	outer wall of room	296	SF	5	5	RACM	Behind Drywall
3	1	107	276	SM/Friable	Wall plaster	outer wall of room	168	SF	5	5	RACM	Behind Drywall
3	1	108	276	SM/Friable	Wall plaster	outer wall of room	96	SF	5	5	RACM	Behind Drywall
3	1	109	276	SM/Friable	Wall plaster	outer wall of room	88	SF	5	5	RACM	Behind Drywall
3	1	Stair Landing	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	40	SF	4		Cat. I	Stair #2, SE Corner of Bldg.
3	1	Stair Landing	3	MM/Non-Friable	Mastic under HA # 1	floor	40	SF	4		Cat. I	Stair #2, SE Corner of Bldg.
3	2	203	7	MM/Non-Friable	1' x 1' Floor tile; Tan with brown and white streaks	floor	28	SF	4		Cat. I	Women's Bathroom
3	2	204	7	MM/Non-Friable	1' x 1' Floor tile; Tan with brown and white streaks	floor	28	SF	4		Cat. I	Men's Bathroom
3	2	Stair Landing	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	96	SF	4		Cat. I	
3	2	Stair Landing	3	MM/Non-Friable	Mastic under HA # 1	floor	96	SF	4		Cat. I	
3	2	Stair Landing	134	TSI/Friable	Drain fittings <2" - >6" diameter	above ceiling	5	FTG	3	5	RACM	SE Landing
3	Elevator	Elevator	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	30	SF	4		Cat. I	
3	Elevator	Elevator	3	MM/Non-Friable	Mastic under HA # 1	floor	30	SF	4		Cat. I	

Bldg.	Floor	Room No	HA	Material Type	Homogeneous Area Description	Location	Qty	Unit	Response Category	AHERA Assessment	NESHAP Category	Comments
22	G	G3	20	MM/Non-Friable	1' x 1' Floor tile; White with grey flecks	floor	351	SF	4		Cat. I	
22	G	G3	23	MM/Non-Friable	Mastic under HA # 20	floor	351	SF	4		Cat. I	
22	G	G4	20	MM/Non-Friable	1' x 1' Floor tile; White with grey flecks	floor	365	SF	4		Cat. I	1 Tiles Damaged at Rear Counter
22	G	G4	23	MM/Non-Friable	Mastic under HA # 20	floor	365	SF	4		Cat. I	
22	G	G4	239	MM/Non-Friable	Black Lab Tops with groove under lip	counter tops	50	SF	5		Cat. II	
22	G	G8	20	MM/Non-Friable	1' x 1' Floor tile; White with grey flecks	floor	380	SF	4		Cat. I	
22	G	G8	23	MM/Non-Friable	Mastic under HA # 20	floor	380	SF	4		Cat. I	
22	G	G8a	20	MM/Non-Friable	1' x 1' Floor tile; White with grey flecks	floor	44	SF	4		Cat. I	
22	G	G8a	23	MM/Non-Friable	Mastic under HA # 20	floor	95	SF	4		Cat. I	
22	G	G10	20	MM/Non-Friable	1' x 1' Floor tile; White with grey flecks	floor	587	SF	4		Cat. I	
22	G	G10	23	MM/Non-Friable	Mastic under HA # 20	floor	587	SF	4		Cat. I	
22	G	G12	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	180	SF	4		Cat. I	**NO ACCESS**
22	G	G12	3	MM/Non-Friable	Mastic under HA # 1	floor	180	SF	4		Cat. I	**NO ACCESS**
22	G	G12a	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	216	SF	4		Cat. I	**NO ACCESS** -Rooms 12a & 12b Combined
22	G	G12a	3	MM/Non-Friable	Mastic under HA # 1	floor	216	SF	4		Cat. I	**NO ACCESS** -Rooms 12a & 12b Combined
22	G	G21	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	36	SF	4		Cat. I	New Carpeting - Can't verify if floor tile was abated
22	G	G21	3	MM/Non-Friable	Mastic under HA # 1	floor	36	SF	4		Cat. I	New Carpeting - Can't verify if floor tile was abated
22	G	G23	1	MM/Non-Friable	1' x 1' Floor tile; Cream with brown streaks (light and dark)	floor	220	SF	4		Cat. I	New Carpeting - Can't verify if floor tile was abated

Bldg.	Floor	Room No	HA	Material Type	Homogeneous Area Description	Location	Qty	Unit	Response Category	AHERA Assessment	NESHAP Category	Comments
22	G	G23	3	MM/Non-Friable	Mastic under HA # 1	floor	220	SF	4		Cat. I	New Carpeting - Can't verify if floor tile was abated
22	G	West Corridor	6	TSI/Friable	Mudded pipe fittings on steam lines; <2" diameter pipes	Hangers on Riser	2	FTG	3	5	RACM	Near Doorway to Bldg. 31 Not Labeled
22	G	Stair #1	6	TSI/Friable	Mudded pipe fittings on steam lines; <2" diameter pipes	above ceiling & 2 Risers	15	FTG	1	1	RACM	Damaged at Floor
22	1	105	20	MM/Non-Friable	1' x 1' Floor tile; White with grey flecks	floor	528	SF	4		Cat. I	
22	1	105	23	MM/Non-Friable	Mastic under HA # 20	floor	528	SF	4		Cat. I	
22	1	105a	20	MM/Non-Friable	1' x 1' Floor tile; White with grey flecks	floor	93	SF	4		Cat. I	
22	1	105a	23	MM/Non-Friable	Mastic under HA # 20	floor	93	SF	4		Cat. I	
22	1	111	20	MM/Non-Friable	1' x 1' Floor tile; White with grey flecks	floor	520	SF	4		Cat. I	
22	1	111	23	MM/Non-Friable	Mastic under HA # 20	floor	520	SF	4		Cat. I	
22	1	111a	20	MM/Non-Friable	1' x 1' Floor tile; White with grey flecks	floor	90	SF	4		Cat. I	
22	1	111a	23	MM/Non-Friable	Mastic under HA # 20	floor	90	SF	4		Cat. I	
22	1	113	20	MM/Non-Friable	1' x 1' Floor tile; White with grey flecks	floor	234	SF	4		Cat. I	
22	1	113	23	MM/Non-Friable	Mastic under HA # 20	floor	234	SF	4		Cat. I	
22	1	114	20	MM/Non-Friable	1' x 1' Floor tile; White with grey flecks	floor	179	SF	4		Cat. I	
22	1	114	23	MM/Non-Friable	Mastic under HA # 20	floor	179	SF	4		Cat. I	
22	1	Corridor	20	MM/Non-Friable	1' x 1' Floor tile; White with grey flecks	floor	825	SF	4		Cat. I	All 4 Corridors Combined
22	1	Corridor	23	MM/Non-Friable	Mastic under HA # 20	floor	825	SF	4		Cat. I	All 4 Corridors Combined
22	Roof	Penthouse	297	MM/Non-Friable	Duct Putty: Light Brown	HVAC Ductwork	33	LF	4		Cat. II	Possibly more underneath fiberglass insulation on Seams
22	Roof	Penthouse	298	SM/Friable	Spray-on insulation: Stairwell	Chase	20	SF	2	2	RACM	Removed in Stairwell Still Present in Chase

Bldg.	Floor	Room No	HA	Material Type	Homogeneous Area Description	Location	Qty	Unit	Response Category	AHERA Assessment	NESHAP Category	Comments
28	1	Stair #1	224	MM/Non-Friable	Linoleum, Beige with brown streaks	floor	244	SF	4	5	Cat. I	Duct Tape on Linoleum
28	1	Stair #2	224	MM/Non-Friable	Linoleum, Beige with brown streaks	floor	153	SF	4		Cat. I	

September 22, 2014

[eco]
ENVIRONMENTAL
COMPLIANCE OFFICE INC
Regulations Standards Compliance

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Contract No. VA 251-14-Q-0329

Building No. 22
Research Building (Original)
Lead Based Paint Assessment
Veterans Affairs Medical Center
Ann Arbor, Michigan

Prepared for:

Department of Veterans Affairs
Facilities Management Services/IH
2215 Fuller Road
Ann Arbor, Michigan 48105

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Executive Summary

Environmental Compliance Office, Inc. (ECO) was engaged to perform a lead based paint inspection of buildings located at the Veterans Affairs Medical Center located at 2215 Fuller Road, Ann Arbor, Michigan. The purpose of this inspection was to determine the presence or absence of Lead Based Paint (LBP), as defined by the United States Environmental Protection Agency (USEPA) and the Michigan Department of Community Health (MDCH).

This report relates to inspection of Building No. 22 – Research Building (Original) located at the Veteran Affairs Medical Center. A detailed examination of the building was performed on August 2 & 4, 2014 to determine the presence or absence of Lead Based Paint (LBP). The building was examined from inside and outside. A thorough inspection of painted surfaces using a portable X-Ray Fluorescence Analyzer was performed to determine the presence of lead.

ECO employed a three person inspection team to perform the detailed building examination and surface analyses conducted at the VA Medical Center from August 1, 2014 through August 31, 2014. The inspection team consisted of Mr. Douglas Haase (MDCH License P-00383), Mr. James Sundberg (MDCH License P-06383), and Mr. Dennis Karl (MDCH License P-06358).

Surface-by-surface inspection of building interior and exterior using portable XRF Analyzer revealed the presence of lead in exterior painted surfaces (painted curbs). A total of 550 surfaces were analyzed by this inspection. Test results are presented in Appendix 1. Building schematics indicating the location of positive lead-based paint results are presented in Appendix 2. Photographs illustrating the positive lead-based paint components are presented in Appendix 3. The following summarizes positive Lead-based paint test results.

Lead Summary Table
Building No. 22
VA Medical Center
Ann Arbor, MI

Room Equivalent	Component Type	Substrate	Paint Color	Classification*** Lead Based Paint	Approx. Quantity (ft^2 or units)	Condition*	Photo ID a/
Building (Exterior)	Curbs	Concrete	Yellow	Positive	500 ft	Deteriorated	PB 1 & 2

*** **Classification is based on XRF results (provided in Appendix of this Report).**

* **Deteriorated paint is defined in 40 CFR 745 Supart L as paint that is cracking, flaking, chipping, peeling, or otherwise separating from the substrate of a building component. This classification takes precedence over the HUD classifications of Paint Condition (Intact, Fair, and Poor) as it is more stringent.**

a/ **Representative photo's as needed.**

Introduction

Environmental Compliance Office, Inc. (ECO) was engaged to perform a lead based paint inspection of buildings located at the Veterans Affairs Medical Center located at 2215 Fuller Road, Ann Arbor, Michigan. The purpose of this inspection was to determine the presence or absence of Lead Based Paint (LBP), as defined by the United States Environmental Protection Agency (USEPA) and the Michigan Department of Community Health (MDCH).

Building No. 22 – Research Building (Original) is a two story medical building used for research. Building No. 22 is located at the North-center of the Medical Center site. The building houses office space and laboratories on both levels (first and second floors). Building access is on the first floor. The building is constructed of steel and masonry with the exterior clad in brick veneer.

A detailed examination of the building was performed on August 2 & 4, 2014 to determine the presence or absence of Lead Based Paint (LBP). The building was examined from inside and outside. A thorough inspection of painted surfaces using a portable X-Ray Fluorescence Analyzer was performed to determine the presence of lead.

ECO employed a three person inspection team to perform the detailed building examination and surface analyses conducted at the Veterans Affairs Medical Center from August 1, 2014 through August 31, 2014. The inspection team consisted of Mr. Douglas Haase (MDCH License P-00383), Mr. James Sundberg (MDCH License P-06383), and Mr. Dennis Karl (MDCH License P-06358). Certification credentials are presented in Appendix 4.

Survey Methodology

ECO conducted a visual survey of Building No. 22 – Research Building (Original) and a surface-by-surface inspection of all painted, varnished, and shellacked finishes using a portable X-Ray Fluorescence Analyzer (XRF) to determine the presence of lead. Even though not applicable on this type of property, the protocol used for this inspection is based on the practices and procedures in the United States Department of Housing and Urban Development's (HUD) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, 2012 (HUD Guidelines), the United States Environmental Protection Agency's (USEPA) 40 CFR Part 745 (Lead; Identification of Dangerous Levels of Lead; Final Rule; January 5, 2001), and the Michigan Department of Community Health (MDCH) MCL 333.5451 to 333.5477. All painted, varnished, and shellacked components were inspected for the presence of Lead Based Paint (LBP).

All components were labeled and analyzed via X-Ray Fluorescence Analyzer (XRF). The Inspection was conducted utilizing the Radiation Monitoring Devices' (RMD) LPA-1 XRF (Serial Number 1377) or ThermoFisher Scientific (Niton) XLp 300 XRF (Serial Number 16325 or 24019). The XRF fieldwork was conducted in accordance with the guidelines outlined in the EPA Performance Characteristic Sheets (Appendix 5). In addition, please note the report does

not label locations as North, East, South, and West. It utilizes A, B, C, and D. For this report, A corresponds to the north wall of each buildings and rooms. Walls B, C, and D are labeled from A in a clockwise manner. For each building, Wall A is to the North, Wall B is to the East, Wall C is to the South, and Wall D is to the West.

Summary of Findings

The following summarizes the findings of the inspection of Building No. 22 – Research Building (Original) for lead-based paint.

Surface-by-surface inspection of building interior and exterior using portable XRF Analyzer revealed the presence of lead in exterior painted surfaces (painted curbs). A total of 550 surfaces were analyzed by this inspection. Test results are presented in Appendix 1. Building schematics indicating the location of positive lead-based paint results are presented in Appendix 2. Photographs illustrating representative examples of the positive lead-based paint components are presented in Appendix 3. The inspection followed practices and procedures in the United States Department of Housing and Urban Development's (HUD) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, 2012 (HUD Guidelines), the United States Environmental Protection Agency's (USEPA) 40 CFR Part 745 (Lead; Identification of Dangerous Levels of Lead; Final Rule; January 5, 2001), and the Michigan Department of Community Health (MDCH) MCL 333.5451 to 333.5477.

Statement of Limitations

Staff of ECO has performed the tasks requested by the Client in a thorough and professional manner consistent with commonly accepted standard industry practices, using state of the art practices and best available known technology, as of the date of the assessment. ECO cannot guarantee and does not warrant that this assessment/limited lead based paint inspection has identified all adverse environmental factors and/or conditions affecting the subject property on the date of the assessment. ECO cannot and will not warrant that the assessment/limited lead-based paint inspection that was requested by the Client will satisfy the dictates of, or provide a legal defense in connection with, any environmental laws or regulations. It is the responsibility of the Client to know and abide by all applicable laws, regulations, and standards, including EPA's Renovation, Repair, and Painting regulation.

The results reported and conclusions reached by ECO are solely for the benefit of the Client. The results and opinions in this report, based solely upon the conditions found on the property as of the date of the assessment, will be valid only as of the date of the assessment. ECO assumes no obligation to advise the Client of any changes in any real or potential lead hazards at this location that may or may not be brought to our attention. Further conditions and limitations to this contracted report are included in the general terms and conditions supplied to the Client with the contract for services.

Worker Protection (OSHA)

The United States Occupational Safety and Health Administration (OSHA) considers lead in paint to be any detectable level of lead concentration to be a concern during renovation and demolition activities, as indicated in the OSHA Lead in Construction Standard (29 CFR 1926.62). The purpose of the OSHA Lead in Construction Standard is to protect construction workers from exposure to lead dust and fumes. OSHA is primarily concerned with activities that disturb paints with detectable amounts of lead. Several painted surfaces at the property were determined to contain lead that may be above the OSHA level of concern.

The most effective way to determine if lead dust will be a health concern during renovation is to conduct a Negative Exposure Assessment (NEA) to determine if the amount of generated lead dust would exceed the Permissible Exposure Limit (PEL) for lead dust or fumes. In general, a NEA is a measurement of a known, airborne contaminant (e.g., lead) over period of eight hours. If the amount of airborne lead in the area is less than the PEL (as calculated by a qualified laboratory) than non-abatement workers would be allowed to perform the work provided that:

1) The NEA information is given to the contractor and s/he agrees to it;

2) the contractor does not deviate from the process that was measured during the NEA, and;

3) the NEA has been performed within the previous 12 months.

Glossary

Accessible Area	Areas that may be visually inspected without need for special safety precautions or measures.
CFR	Code of Federal Regulations.
Deteriorated paint	Any paint coating on a damaged or deteriorated surface or fixture, or any interior or exterior lead-based paint that is peeling, chipping, blistering, flaking, worn, chalking, alligatoring, cracking, or otherwise becoming separated from the substrate.
Doors	Door, door jamb, door casing see component identification in Illustration 1.
Intact paint	Painted surface that is not deteriorated.
LBP	Lead-based paint.
Lead	Lead includes metallic lead and organic compounds of lead.
Lead-based paint	Any paint, varnish, shellac, or other coating that contains lead equal to or greater than 1.0 mg/cm^2 as measured by XRF or laboratory analysis, or 0.5 percent by weight (5000 mg/g, 5000 ppm, or 5000 mg/kg) as measured by laboratory analysis.
Lead-based paint free	A property where no lead in amounts greater than or equal to 1.0 mg/cm^2 in paint (or surface coatings) was found on any building components, using the inspection protocol in Chapter 7 of the *HUD Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* (2012 Revision). Note, OSHA does not consider whether paint is lead-based paint in its regulations; its regulations focus on whether workers may be exposed to lead whatever the source.
MDCH	Michigan Department of Community Health.
NVLAP	National Voluntary Laboratory Accreditation Program, a laboratory certification program of the National Institute of Standards and Technology (NIST).
OSHA	The United States Occupational Safety and Health Administration (OSHA).
PEL	Permissible Exposure Limit.
Stairs	Railing, treads, risers, stringers, posts see component identification in Illustration 2.

USEPA	United States Environmental Protection Agency. Created in 1970, the U.S. EPA is the federal promulgator and enforcement agency for environmental regulations.
Windows	Sills, casings, sashes see component identification in Illustration 3.
XRF Analyzer	An instrument that determines lead concentration in milligrams per square centimeter (mg/cm^2) using the principle of X-ray fluorescence (XRF).

Illustration 1 - Doors

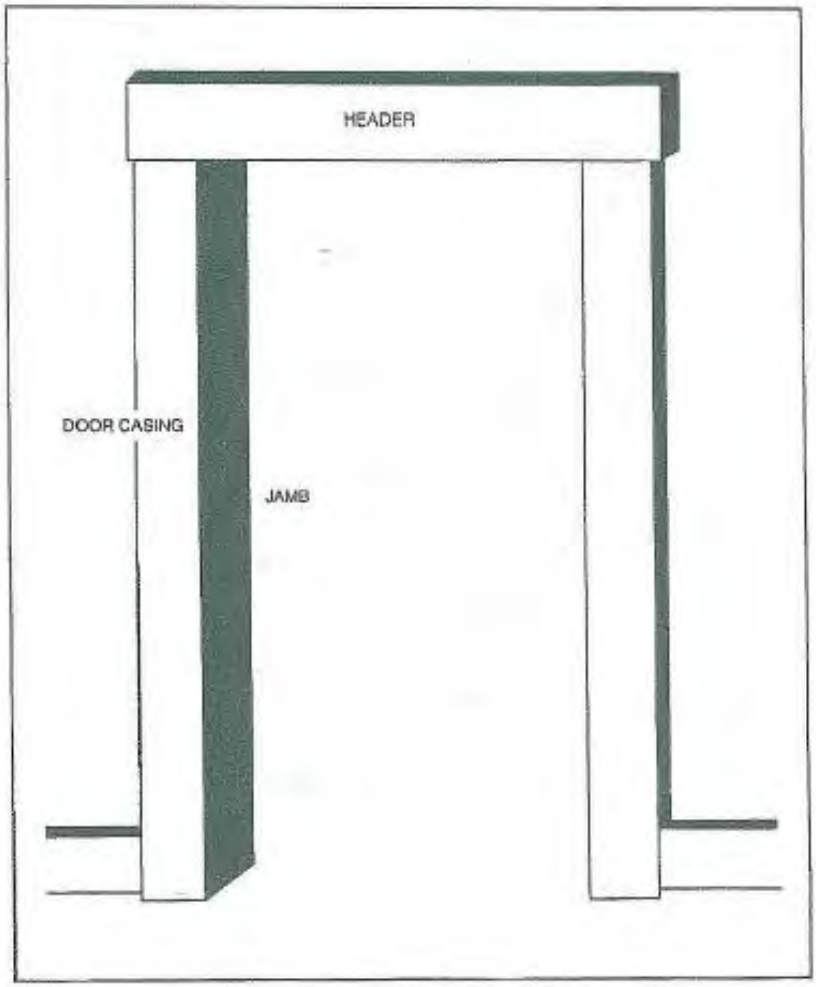


Illustration 2 - Stairs

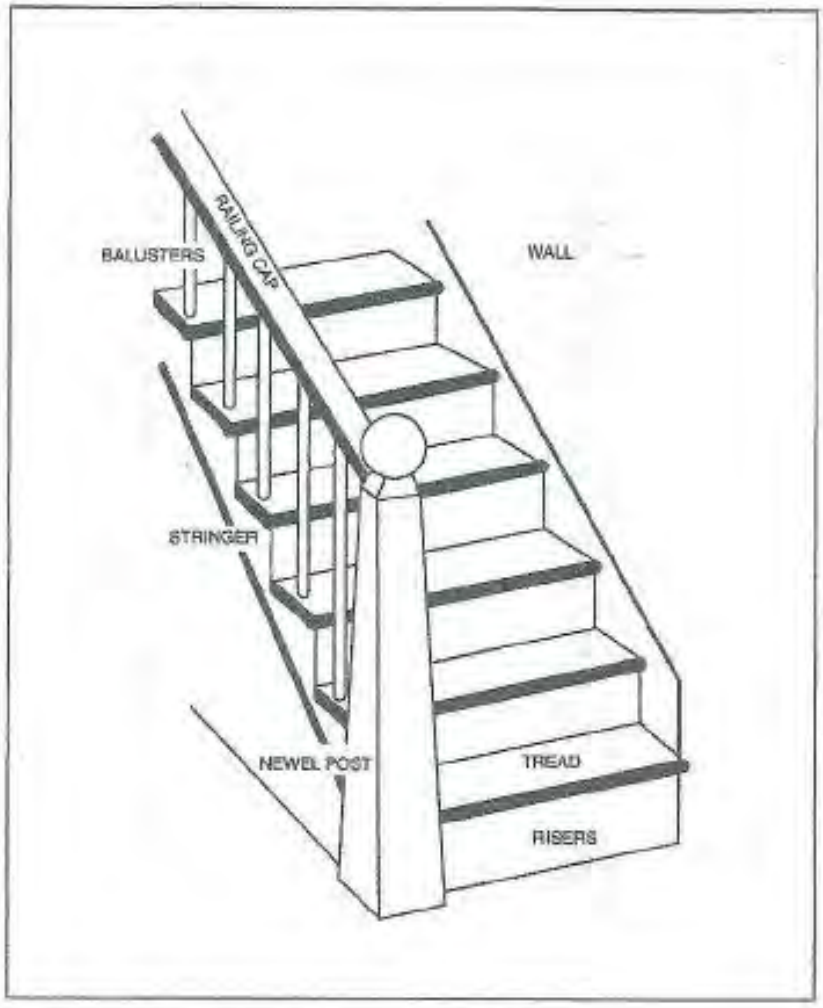
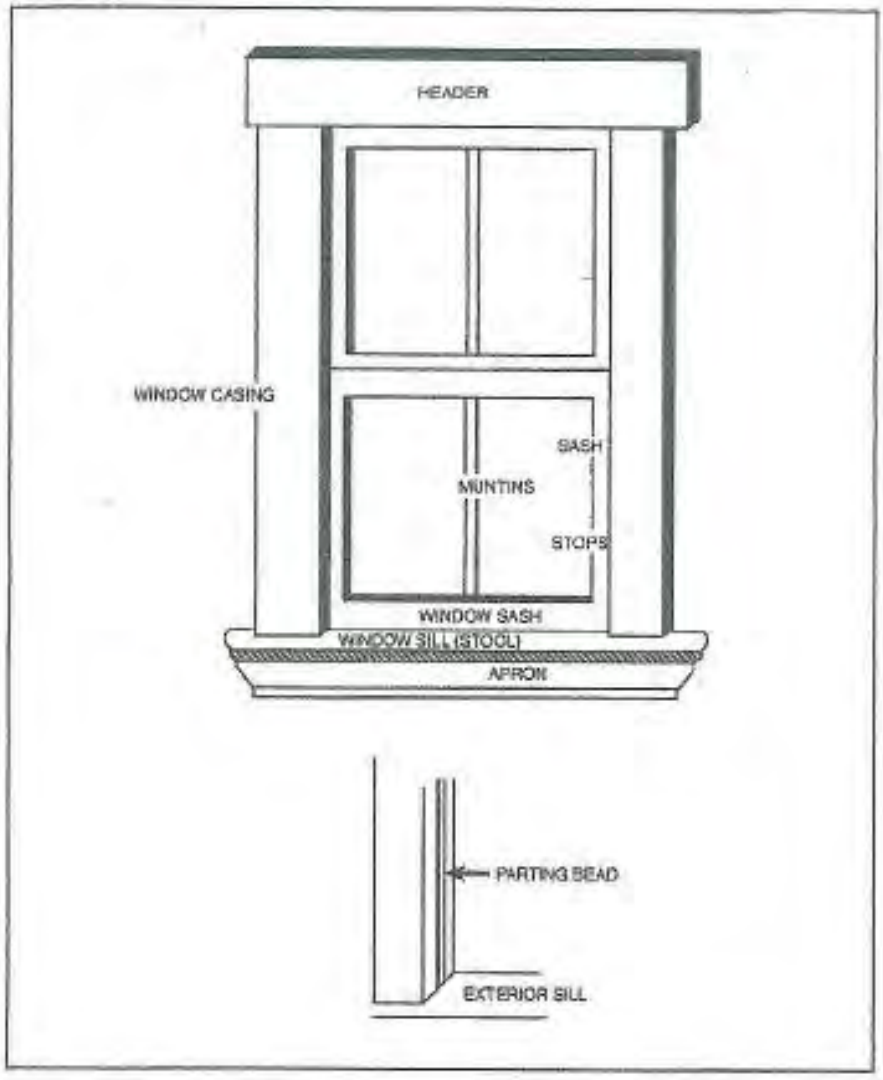


Illustration 3 - Windows



Appendix 1 – Test Results

No.	Location/ Room	Wall	Component			Substrate	Color	Condition	Reading (gm/cm^2)
			Structure	Location	Member				
1	Calibration								0.9
2	Calibration								0.8
3	Calibration								0.8
4	G Hall	A	Wall	U Lft		Drywall	Yellow	Intact	-0.2
5	G Hall	B	Wall	U Ctr		Drywall	Yellow	Intact	-0.1
6	G Hall	C	Wall	U Rgt		Drywall	Yellow	Intact	0.0
7	G Hall	D	Wall	U Rgt		Drywall	Yellow	Intact	0.1
8	G Hall	D	Wall	L Lft		Concrete	Yellow	Intact	0.2
9	G Hall	D	Rad Cover	Lft		Metal	Yellow	Intact	0.0
10	G Hall	D	Door	Rgt	U Ctr	Metal	Yellow	Intact	0.4
11	G Hall	D	Door	Rgt	Rgt jamb	Metal	Yellow	Intact	0.1
12	G Hall	A	Elec Panel	Lft		Metal	Gray	Intact	0.2
13	G Hall	A	Door	Lft	U Ctr	Metal	White	Intact	0.1
14	G Hall	D	El Dr Pnl	Ctr		Metal	Blue	Intact	-0.1
15	G Hall	D	Wall	L Rgt		Conc Block	Yellow	Intact	0.0
16	G Hall	C	Wall	L Rgt		Conc Block	Yellow	Intact	0.0
17	G Hall	B	Wall	L Rgt		Conc Block	Yellow	Intact	0.3
18	G Hall	D	Pipe	Ctr		Wrapped	Yellow	Intact	0.0
19	G W Toil	B	Divider	Rgt		Metal	Pink	Intact	0.1
20	G W Toil	C	Door	Rgt	U Ctr	Metal	White	Intact	0.3
21	G W Toil	C	Door	Rgt	Lft jamb	Metal	White	Intact	0.2
22	G W Toil	C	Ceiling			Drywall	White	Intact	0.2
23	G W Toil	C	Wall	U Rgt		Drywall	White	Intact	0.2
24	G W Toil	D	Wall	U Ctr		Drywall	White	Intact	0.0
25	G W Toil	A	Wall	U Lft		Drywall	White	Intact	0.0
26	G W Toil	B	Wall	U Lft		Drywall	White	Intact	-0.2
27	G W Toil	D	Wall	U Ctr		Drywall	Blue	Intact	0.0
28	G W Toil	C	Wall	U Ctr		Drywall	Blue	Intact	-0.2
29	G W Toil	B	Wall	U Ctr		Drywall	Blue	Intact	-0.1
30	G W Toil	A	Wall	U Ctr		Drywall	Blue	Intact	0.0
31	G W Toil	D	Ceiling			Drywall	Blue	Intact	0.0
32	G W Toil	D	Access Door	Ctr		Metal	Blue	Intact	-0.1
33	G W Toil	B	Divider	Ctr		Metal	Blue	Intact	-0.1
34	G W Toil	A	Door	Lft	U Ctr	Metal	Brown	Intact	0.0
35	G W Toil	A	Door	Lft	Lft casing	Metal	Brown	Intact	-0.1
36	G06	C	Door	Rgt	Lft jamb	Metal	Yellow	Intact	-0.1
37	G06	C	Door	Rgt	U Ctr	Metal	Yellow	Intact	-0.1
38	G06	A	Cabinet	Ctr		Metal	Gray	Intact	0.0
39	G06	A	Wall	U Ctr		Drywall	Yellow	Intact	0.1
40	G06	B	Wall	U Ctr		Drywall	Yellow	Intact	0.2
41	G06	C	Wall	U Ctr		Drywall	Yellow	Intact	0.0
42	G06	D	Wall	U Ctr		Drywall	Yellow	Intact	0.1
43	G07	D	Wall	U Ctr		Metal	White	Intact	0.1

No.	Location/ Room	Wall	Component			Substrate	Color	Condition	Reading (gm/cm^2)
			Structure	Location	Member				
44	G07	A	Wall	U Ctr		Metal	White	Intact	-0.1
45	G07	B	Wall	U Ctr		Metal	White	Intact	0.1
46	G07	C	Wall	U Ctr		Metal	White	Intact	0.1
47	G07	C	Door	Ctr	U Ctr	Metal	White	Intact	0.0
48	G07	C	Ceiling			Metal	White	Intact	-0.2
49	G17	B	Access Door	Rgt		Metal	Yellow	Intact	0.1
50	G17	A	Door	Lft	U Ctr	Metal	Yellow	Intact	0.2
51	G17	A	Door	Lft	Rgt jamb	Metal	Yellow	Intact	0.0
52	G17	A	Wall	L Ctr		Drywall	Yellow	Intact	-0.2
53	G17	B	Wall	L Ctr		Drywall	Yellow	Intact	0.0
54	G17	C	Wall	L Ctr		Drywall	Yellow	Intact	-0.1
55	G17	D	Wall	L Ctr		Drywall	Yellow	Intact	0.0
56	G17	D	Ceiling			Drywall	Yellow	Intact	0.0
57	G17A	D	Ceiling			Drywall	Yellow	Intact	0.0
58	G17A	D	Wall	U Rgt		Drywall	Yellow	Intact	0.1
59	G17A	C	Wall	U Lft		Drywall	Yellow	Intact	0.0
60	G17A	B	Wall	U Lft		Drywall	Yellow	Intact	0.0
61	G17A	A	Wall	U Lft		Drywall	Yellow	Intact	0.1
62	G17A	A	Door	Lft	U Ctr	Metal	Yellow	Intact	-0.1
63	G17A	A	Door	Lft	Rgt casing	Metal	Yellow	Intact	0.0
64	G17A	A	Access Door	Ctr		Metal	Yellow	Intact	-0.2
65	G08	D	Door	Lft	U Ctr	Metal	Yellow	Intact	0.2
66	G08	D	Door	Lft	Rgt jamb	Metal	Yellow	Intact	0.2
67	G08	D	Cabinet	Ctr		Metal	Yellow	Intact	0.1
68	G08	D	Hood	Ctr		Metal	Blue	Intact	0.0
69	G08	D	Duct	Ctr		Metal	White	Intact	0.1
70	G08	A	Wall	L Lft		Concrete	White	Intact	-0.1
71	G08	A	Wall	U Lft		Conc Block	White	Intact	-0.2
72	G08	B	Wall	U Lft		Drywall	White	Intact	-0.3
73	G08	C	Wall	U Rgt		Drywall	White	Intact	0.1
74	G08	D	Wall	U Lft		Drywall	White	Intact	0.0
75	G08 Sink	D	Wall	U Ctr		Drywall	White	Intact	-0.1
76	G08 Sink	C	Wall	U Ctr		Drywall	White	Intact	0.1
77	G08 Sink	B	Wall	U Lft		Drywall	White	Intact	-0.1
78	G08 Sink	A	Wall	U Ctr		Drywall	White	Intact	0.0
79	G08 Sink	B	Door	Rgt	U Ctr	Metal	White	Intact	0.0
80	G08 Sink	B	Door	Rgt	Rgt casing	Metal	White	Intact	0.0
81	G08 Sink	B	Floor			Concrete	Gray	Intact	-0.1
82	G09	D	Floor			Concrete	Gray	Intact	-0.2
83	G09	D	Ceiling			Drywall	White	Intact	0.0
84	G09	D	Wall	U Lft		Drywall	Blue	Intact	-0.2
85	G09	C	Wall	L Ctr		Drywall	Blue	Intact	0.1

No.	Location/ Room	Wall	Component			Substrate	Color	Condition	Reading (gm/cm^2)
			Structure	Location	Member				
86	G09	B	Wall	U Rgt		Drywall	Blue	Intact	0.0
87	G09	A	Wall	U Rgt		Drywall	Blue	Intact	0.0
88	G08A	A	Wall	U Ctr		Conc Block	Blue	Intact	0.0
89	G08A	B	Wall	U Ctr		Drywall	Blue	Intact	0.0
90	G08A	C	Wall	U Ctr		Drywall	Blue	Intact	0.0
91	G08A	D	Wall	U Ctr		Drywall	Blue	Intact	-0.1
92	G08A	D	Door	Lft	U Ctr	Wood	Blue	Intact	-0.1
93	G08A	D	Door	Lft	Lft jamb	Metal	Blue	Intact	0.0
94	G10	C	Door	Rgt	Lft casing	Metal	Blue	Intact	0.3
95	G10	C	Door	Rgt	U Ctr	Wood	Blue	Intact	0.0
96	G10	C	Wall	L Rgt		Drywall	Blue	Intact	0.0
97	G10	B	Wall	U Ctr		Drywall	Blue	Intact	0.2
98	G10	A	Wall	U Ctr		Drywall	Blue	Intact	0.2
99	G10	D	Wall	U Ctr		Drywall	Blue	Intact	0.1
100	G10	B	Cabinet	Ctr		Metal	Blue	Intact	0.1
101	G10	A	Hood	Ctr		Metal	Blue	Intact	0.0
102	G10	A	I-Beam	Ctr		Metal	Brown	Intact	0.0
103	G10	B	I-Beam	Ctr		Metal	Brown	Intact	0.1
104	G10	C	I-Beam	Ctr		Metal	Brown	Intact	0.1
105	G10	D	I-Beam	Ctr		Metal	Brown	Intact	-0.1
106	G10	A	I-Beam	Ctr		Metal	Brown	Intact	0.0
107	G11	C	Door	Lft	Lft jamb	Metal	Beige	Intact	0.0
108	G11	C	Door	Lft	U Ctr	Metal	Beige	Intact	0.0
109	G11	C	Wall	U Ctr		Drywall	Beige	Intact	0.0
110	G11	B	Wall	U Ctr		Drywall	Beige	Intact	0.0
111	G11	D	Wall	U Ctr		Drywall	Beige	Intact	0.0
112	G11	A	Wall	U Ctr		Concrete	Beige	Intact	0.0
113	G11	D	Ceiling			Drywall	Beige	Intact	0.3
114	G11	D	Access Door	Rgt		Metal	Beige	Intact	0.0
115	G01B	B	Cabinet	Ctr		Metal	Gray	Intact	0.2
116	G01B	C	Hood	Rgt		Metal	Yellow	Intact	0.0
117	G01B	A	Door	Lft	Lft jamb	Metal	Yellow	Intact	-0.1
118	G01B	A	Door	Lft	U Ctr	Metal	Yellow	Intact	-0.2
119	G01B	A	Wall	U Lft		Drywall	Yellow	Intact	-0.2
120	G01B	B	Wall	L Lft		Drywall	Yellow	Intact	-0.2
121	G01B	C	Wall	U Lft		Drywall	Yellow	Intact	-0.1
122	G01B	D	Wall	U Lft		Drywall	Yellow	Intact	0.0
123	G14	D	Wall	U Ctr		Drywall	White	Intact	-0.1
124	G14	C	Wall	U Ctr		Drywall	White	Intact	-0.1
125	G14	B	Wall	U Ctr		Drywall	White	Intact	0.0
126	G14	A	Wall	U Ctr		Drywall	White	Intact	0.0
127	G14	C	Ceiling			Drywall	White	Intact	0.0

No.	Location/ Room	Wall	Component			Substrate	Color	Condition	Reading (gm/cm^2)
			Structure	Location	Member				
128	G14	C	Door	Ctr	U Ctr	Metal	White	Intact	0.0
129	G14	C	Door	Ctr	Rgt jamb	Metal	White	Intact	0.1
130	G14	C	Elec Panel	Ctr		Metal	Gray	Intact	0.2
131	G14	C	Cabinet	Lft		Metal	Blue	Intact	0.0
132	G14	C	Floor			Concrete	Blue	Intact	-0.1
133	G5	C	Cabinet	Ctr		Metal	Blue	Intact	-0.1
134	G5	D	Hood	Lft		Metal	White	Intact	-0.1
135	G5	D	Duct	Lft		Metal	White	Intact	0.2
136	G5	A	Door	Lft	U Ctr	Metal	White	Intact	0.1
137	G5	A	Door	Lft	Rgt casing	Metal	White	Intact	0.0
138	G5	A	Wall	U Lft		Drywall	White	Intact	0.1
139	G5	B	Wall	U Ctr		Drywall	White	Intact	0.1
140	G5	C	Wall	U Lft		Drywall	White	Intact	-0.2
141	G5	D	Ceiling			Drywall	White	Intact	0.0
142	G5	D	Wall	L Ctr		Drywall	White	Intact	-0.1
143	G5	B	Elec Panel	Lft		Metal	Gray	Intact	0.1
144	G5A	C	Door	Ctr	Lft jamb	Metal	Beige	Intact	-0.2
145	G5A	C	Door	Ctr	U Ctr	Wood	Beige	Intact	-0.1
146	G5A	C	Wall	U Lft		Drywall	Beige	Intact	-0.2
147	G5A	B	Wall	U Ctr		Drywall	Beige	Intact	-0.1
148	G5A	A	Wall	U Ctr		Drywall	Beige	Intact	0.0
149	G5A	D	Wall	U Ctr		Drywall	Beige	Intact	-0.1
150	G5A	D	Ceiling			Drywall	White	Intact	0.0
151	1 Hall	A	Wall	L Rgt		Drywall	White	Intact	0.1
152	1 Hall	B	Wall	L Rgt		Drywall	White	Intact	-0.1
153	1 Hall	C	Wall	L Ctr		Drywall	White	Intact	-0.3
154	1 Hall	D	Wall	L Ctr		Drywall	White	Intact	-0.3
155	1 Hall	D	Wall	L Ctr		Conc Block	White	Intact	-0.3
156	1 Hall	B	Wall	L Lft		Conc Block	White	Intact	-0.2
157	1 Hall	A	Wall	L Rgt		Conc Block	White	Intact	-0.2
158	1 Hall	A	Door	Lft	U Ctr	Metal	White	Intact	0.3
159	1 Hall	D	Rad Cover	Ctr		Metal	White	Intact	-0.1
160	1 Hall	D	El Dr Pnl	Rgt		Metal	Blue	Intact	0.1
161	1 Hall	B	Door	Lft	Lft casing	Metal	Beige	Intact	0.0
162	1 Hall	B	Door	Lft	U Ctr	Metal	Beige	Intact	0.3
163	1 Hall	D	Door	Rgt	U Ctr	Wood	Beige	Intact	0.0
164	108A	D	Wall	L Ctr		Conc Block	White	Intact	-0.2
165	108A	A	Wall	L Ctr		Conc Block	White	Intact	0.2
166	108A	B	Wall	U Ctr		Drywall	White	Intact	0.0
167	108A	C	Wall	U Ctr		Drywall	White	Intact	0.3
168	108A	B	Door	Rgt	U Ctr	Wood	White	Intact	0.0
169	108A	B	Door	Rgt	Lft jamb	Metal	White	Intact	0.2

No.	Location/ Room	Wall	Component			Substrate	Color	Condition	Reading (gm/cm^2)
			Structure	Location	Member				
170	108	D	Door	Rgt	Rgt jamb	Metal	White	Intact	0.0
171	108	A	Hood	Lft		Metal	White	Intact	-0.1
172	108	A	Cabinet	Lft		Metal	White	Intact	-0.2
173	108	A	Wall	U Ctr		Conc Block	White	Intact	-0.2
174	108	B	Wall	U Ctr		Drywall	White	Intact	0.2
175	108	C	Wall	U Ctr		Drywall	White	Intact	-0.1
176	108	D	Wall	U Ctr		Drywall	White	Intact	-0.1
177	108	C	Door	Ctr	U Ctr	Wood	White	Intact	0.0
178	108	C	Elec Panel	Rgt		Metal	Gray	Intact	-0.1
179	108	C	Door	Ctr	Lft jamb	Metal	Gray	Intact	-0.1
180	108	D	Cabinet	Ctr		Metal	Gray	Intact	0.0
181	109	D	Hood	Rgt		Metal	Gray	Intact	0.0
182	109	D	Wall	U Ctr		Drywall	Gray	Intact	0.0
183	109	C	Wall	U Ctr		Drywall	Gray	Intact	-0.1
184	109	B	Wall	U Ctr		Drywall	Gray	Intact	0.1
185	109	A	Wall	U Ctr		Conc Block	Gray	Intact	-0.1
186	109	A	Window	Rgt	Sill	Concrete	Gray	Intact	-0.2
187	110	A	Wall	U Ctr		Conc Block	Gray	Intact	0.0
188	110	B	Wall	U Lft		Drywall	Gray	Intact	0.2
189	110	C	Wall	U Lft		Drywall	Gray	Intact	-0.1
190	110	D	Wall	U Rgt		Drywall	Gray	Intact	0.2
191	110	D	Cabinet	Rgt		Metal	Gray	Intact	0.0
192	110	C	Door	Rgt	Lft casing	Metal	Gray	Intact	-0.1
193	110	C	Door	Rgt	U Ctr	Wood	Gray	Intact	-0.1
194	110	C	Elec Panel	Lft		Metal	Gray	Intact	-0.3
195	106 Cold	C	Door	Lft	U Ctr	Metal	White	Intact	-0.3
196	106 Cold	C	Wall	L Lft		Metal	White	Intact	-0.3
197	106 Cold	D	Wall	L Lft		Metal	White	Intact	-0.3
198	106 Cold	A	Wall	L Ctr		Metal	White	Intact	-0.2
199	106 Cold	B	Wall	L Ctr		Metal	White	Intact	-0.2
200	106 Cold	B	Ceiling			Metal	White	Intact	-0.3
201	106 Cold	B	Cabinet	Lft		Metal	Beige	Intact	-0.1
202	107	C	Door	Lft	Lft jamb	Metal	Beige	Intact	-0.2
203	107	C	Door	Lft	U Ctr	Wood	Beige	Intact	-0.2
204	107	C	Wall	U Lft		Drywall	Beige	Intact	0.3
205	107	B	Wall	U Ctr		Drywall	Beige	Intact	-0.2
206	107	A	Wall	U Ctr		Drywall	Beige	Intact	-0.1
207	107	D	Wall	U Ctr		Drywall	Beige	Intact	0.0
208	1 M Toil	A	Ceiling			Drywall	White	Intact	-0.3
209	1 M Toil	A	Wall	U Ctr		Drywall	White	Intact	-0.3
210	1 M Toil	B	Wall	U Ctr		Drywall	White	Intact	-0.2
211	1 M Toil	C	Wall	U Ctr		Drywall	White	Intact	-0.2

No.	Location/ Room	Wall	Component			Substrate	Color	Condition	Reading (gm/cm^2)
			Structure	Location	Member				
212	1 M Toil	D	Wall	U Ctr		Drywall	White	Intact	-0.2
213	1 M Toil	B	Divider	Rgt		Metal	Blue	Intact	-0.3
214	1 M Toil	A	Door	Lft	Lft casing	Metal	Beige	Intact	0.0
215	1 M Toil	A	Door	Lft	U Ctr	Wood	Beige	Intact	-0.3
216	1 W Toil	C	Door	Rgt	U Ctr	Wood	Beige	Intact	-0.1
217	1 W Toil	C	Door	Rgt	Rgt jamb	Metal	Beige	Intact	0.2
218	1 W Toil	B	Divider	Rgt		Metal	Pink	Intact	0.3
219	1 W Toil	B	Ceiling			Drywall	White	Intact	0.3
220	1 W Toil	B	Wall	U Lft		Drywall	White	Intact	0.3
221	1 W Toil	A	Wall	U Ctr		Drywall	White	Intact	0.1
222	1 W Toil	D	Wall	U Ctr		Drywall	White	Intact	0.0
223	1 W Toil	C	Wall	U Ctr		Drywall	White	Intact	0.0
224	105	A	Wall	U Ctr		Drywall	White	Intact	0.0
225	105	B	Wall	U Ctr		Drywall	White	Intact	0.0
226	105	C	Wall	U Rgt		Drywall	White	Intact	-0.2
227	105	D	Wall	U Lft		Drywall	White	Intact	0.0
228	105	D	Wall	L Rgt		Conc Block	White	Intact	0.2
229	105	C	Wall	L Lft		Conc Block	White	Intact	0.0
230	105	C	Window	Lft	Sill	Concrete	White	Intact	0.3
231	105	D	Door	Lft	U Ctr	Wood	White	Intact	-0.1
232	105	D	Door	Lft	Rgt jamb	Metal	White	Intact	0.0
233	105	A	Hood	Rgt		Metal	Blue	Intact	-0.1
234	105	A	Cabinet	Rgt		Metal	Blue	Intact	0.1
235	105A	B	Door	Lft	Lft jamb	Metal	White	Intact	-0.1
236	105A	B	Door	Lft	U Ctr	Wood	White	Intact	-0.1
237	105A	B	Wall	U Ctr		Drywall	White	Intact	-0.1
238	105A	C	Wall	U Ctr		Drywall	White	Intact	-0.1
239	105A	A	Wall	U Lft		Drywall	White	Intact	-0.1
240	105A	D	Wall	L Ctr		Conc Block	White	Intact	0.1
241	115	D	Wall	U Ctr		Plaster	Gray	Intact	0.1
242	115	C	Wall	U Ctr		Plaster	Gray	Intact	0.1
243	115	B	Wall	U Ctr		Plaster	Gray	Intact	0.0
244	115	A	Wall	U Ctr		Plaster	Gray	Intact	0.0
245	115	A	Cabinet	Lft		Metal	Gray	Intact	-0.2
246	115	C	Door	Lft	Lft jamb	Metal	Gray	Intact	0.1
247	115	C	Door	Lft	U Ctr	Wood	Gray	Intact	0.0
248	114	C	Door	Lft	U Ctr	Wood	Beige	Intact	0.0
249	114	C	Door	Lft	Rgt casing	Metal	Beige	Intact	0.0
250	114	C	Elec Panel	Rgt		Metal	Gray	Intact	0.0
251	114	A	Cabinet	Ctr		Metal	Blue	Intact	0.1
252	114	A	Wall	U Ctr		Plaster	Blue	Intact	0.0
253	114	B	Wall	U Ctr		Plaster	Blue	Intact	-0.2

No.	Location/ Room	Wall	Component			Substrate	Color	Condition	Reading (gm/cm^2)
			Structure	Location	Member				
254	114	C	Wall	U Ctr		Plaster	Blue	Intact	-0.1
255	114	D	Wall	U Ctr		Plaster	Blue	Intact	-0.1
256	102	A	Wall	U Ctr		Plaster	Beige	Intact	0.0
257	102	B	Wall	U Ctr		Plaster	Beige	Intact	0.1
258	102	D	Wall	U Ctr		Plaster	Beige	Intact	0.0
259	102	C	Ceiling			Plaster	White	Intact	0.0
260	102	C	Wall	U Ctr		Conc Block	Beige	Intact	0.1
261	102	C	Window	Rgt	Sill	Concrete	Beige	Intact	-0.3
262	102	D	Floor			Concrete	Gray	Intact	0.1
263	102	D	Cabinet	Ctr		Metal	Gray	Intact	-0.2
264	102	A	Door	Ctr	Lft casing	Metal	Gray	Intact	-0.2
265	102	A	Door	Ctr	U Ctr	Wood	Gray	Intact	-0.1
266	101	A	Door	Ctr	U Ctr	Wood	Beige	Intact	-0.2
267	101	A	Door	Ctr	Lft jamb	Metal	Beige	Intact	-0.3
268	101	B	Hood	Ctr		Metal	Beige	Intact	-0.3
269	101	B	Wall	U Lft		Plaster	Beige	Intact	-0.1
270	101	D	Wall	U Ctr		Plaster	Beige	Intact	-0.2
271	101	A	Wall	U Lft		Plaster	Brown	Intact	-0.2
272	101	C	Wall	U Ctr		Conc Block	Beige	Intact	-0.1
273	101	C	Window	Ctr	Sill	Concrete	Beige	Intact	0.0
274	101	C	Floor			Concrete	Gray	Intact	-0.1
275	101	B	Cabinet	Lft		Metal	Gray	Intact	0.0
276	118	A	Elec Panel	Ctr		Metal	Gray	Intact	0.1
277	118	C	Door	Ctr	Lft casing	Metal	Beige	Intact	-0.1
278	118	C	Door	Ctr	U Ctr	Wood	Beige	Intact	0.0
279	118	C	Wall	U Lft		Plaster	Beige	Intact	0.0
280	118	D	Wall	U Lft		Plaster	Beige	Intact	0.0
281	118	A	Wall	U Ctr		Conc Block	Beige	Intact	0.1
282	118	B	Wall	U Ctr		Conc Block	Beige	Intact	-0.1
283	Calibration								0.9
284	Calibration								0.8
285	Calibration								1.0
286	E Stair	A	Wall	U Ctr		Conc Block	Beige	Intact	0.2
287	E Stair	D	Wall	U Ctr		Conc Block	Beige	Intact	0.3
288	E Stair	C	Wall	U Ctr		Conc Block	Beige	Intact	0.0
289	E Stair	B	Wall	U Lft		Conc Block	Beige	Intact	0.0
290	E Stair	B	Window	Lft	Sill	Concrete	Beige	Intact	0.0
291	E Stair	B	Rad Cover	Lft		Metal	Beige	Intact	0.3
292	E Stair	A	Pipe	Rgt		Metal	Beige	Intact	0.0
293	E Stair	D	Door	Rgt	U Ctr	Metal	Black	Intact	0.1
294	E Stair	D	Door	Rgt	Rgt casing	Metal	Black	Intact	0.1
295	E Stair	B	Railing	Ctr	Railing	Metal	Black	Intact	0.2

No.	Location/ Room	Wall	Component			Substrate	Color	Condition	Reading (gm/cm^2)
			Structure	Location	Member				
296	E Stair	B	Stairs	Ctr	Stringer	Metal	Black	Intact	-0.1
297	E Stair	B	Stairs	Ctr	Risers	Metal	Black	Intact	0.2
298	E Stair	D	Gate	Rgt		Metal	Black	Intact	0.2
299	E Stair	D	Duct	Lft		Metal	White	Intact	0.1
300	E Stair	D	Floor			Concrete	Gray	Intact	0.1
301	E Stair	A	Wall	L Ctr		Concrete	Beige	Intact	0.0
302	E Stair	B	Wall	L Ctr		Concrete	Beige	Intact	-0.1
303	B1	A	Ceiling			Concrete	Gray	Intact	0.2
304	B1	A	Wall	U Ctr		Concrete	Blue	Intact	0.3
305	B1	D	Wall	U Ctr		Concrete	Blue	Intact	0.0
306	B1	C	Ceiling			Concrete	Blue	Intact	0.0
307	B1	B	Wall	L Lft		Conc Block	Blue	Intact	0.1
308	B1	C	Wall	U Ctr		Conc Block	Blue	Intact	0.0
309	B1	B	Duct	Rgt		Metal	Blue	Intact	0.0
310	B1	B	Pipe	Ctr		Metal	Blue	Intact	-0.1
311	B1	B	Door	Rgt	Lft casing	Metal	Green	Intact	0.2
312	B1	B	Door	Rgt	U Ctr	Wood	Green	Intact	0.0
313	B3	A	Mount Bd	Lft		Wood	Green	Intact	0.2
314	B3	B	Door	Lft	U Ctr	Metal	Green	Intact	0.0
315	B3	B	Door	Lft	Rgt jamb	Metal	Green	Intact	-0.1
316	B3	B	Pipe	Ctr		Metal	Green	Intact	0.2
317	B3	C	Elec Panel	Ctr		Metal	Gray	Intact	0.0
318	B3	C	Floor			Concrete	Gray	Intact	0.0
319	B3	C	Ceiling			Concrete	Green	Intact	0.2
320	B3	C	Wall	L Ctr		Concrete	Green	Intact	0.2
321	B3	D	Wall	L Lft		Concrete	Green	Intact	0.1
322	B3	A	Wall	U Lft		Conc Block	Green	Intact	0.1
323	B3	B	Wall	U Ctr		Conc Block	Green	Intact	0.0
324	B5	A	Wall	U Ctr		Conc Block	Green	Intact	0.0
325	B5	D	Wall	U Ctr		Conc Block	Green	Intact	0.0
326	B5	C	Wall	U Ctr		Concrete	Green	Intact	0.2
327	B5	B	Wall	L Ctr		Concrete	Green	Intact	-0.1
328	B5	B	Ceiling			Concrete	Green	Intact	0.0
329	B5	B	Floor			Concrete	Gray	Intact	0.0
330	B5	A	Door	Rgt	U Ctr	Metal	Green	Intact	0.0
331	B5	A	Door	Rgt	Rgt jamb	Metal	Green	Intact	0.1
332	B5	A	Pipe	Lft		Metal	Green	Intact	0.1
333	B5	C	Elec Panel	Rgt		Metal	Gray	Intact	0.0
334	B5	C	Pipe	Lft		Wrapped	Green	Intact	0.0
335	Stair 2	A	Stairs	Ctr	Stringer	Metal	Green	Intact	-0.1
336	Stair 2	A	Stairs	Ctr	Treads	Metal	Green	Intact	0.3
337	Stair 2	A	Stairs	Ctr	Railing cap	Metal	Green	Intact	0.3

No.	Location/ Room	Wall	Component			Substrate	Color	Condition	Reading (gm/cm^2)
			Structure	Location	Member				
338	Stair 2	A	Door	Rgt	Lft jamb	Metal	Beige	Intact	0.5
339	Stair 2	A	Door	Rgt	U Ctr	Wood	Beige	Intact	0.2
340	Stair 2	A	Wall	U Ctr		Plaster	Beige	Intact	0.0
341	Stair 2	B	Wall	U Ctr		Conc Block	Beige	Intact	-0.1
342	Stair 2	C	Wall	U Ctr		Conc Block	Beige	Intact	0.0
343	Stair 2	D	Wall	U Ctr		Concrete	Beige	Intact	0.1
344	Penthse	D	Column	Ctr	L column	Metal	Brown	Intact	0.4
345	Penthse	C	Column	Ctr	L column	Metal	Brown	Intact	0.1
346	Penthse	B	Column	Ctr	L column	Metal	Brown	Intact	0.1
347	Penthse	A	Column	Ctr	L column	Metal	Brown	Intact	0.1
348	Penthse	A	I-Beam	Ctr		Metal	Beige	Intact	0.1
349	Penthse	B	I-Beam	Ctr		Metal	Beige	Intact	-0.1
350	Penthse	C	I-Beam	Ctr		Metal	Beige	Intact	0.0
351	Penthse	D	I-Beam	Ctr		Metal	Beige	Intact	0.0
352	Penthse	D	Ceiling			Metal	Beige	Intact	0.3
353	Penthse	A	Door	Lft	U Ctr	Metal	Brown	Intact	0.0
354	Penthse	A	Door	Lft	Rgt casing	Metal	Brown	Intact	-0.1
355	Penthse	A	Elec Panel	Lft		Metal	Gray	Intact	0.2
356	Stair 2	A	I-Beam	Ctr		Metal	Green	Intact	0.2
357	W Stair	B	Railing	Rgt	Railing	Metal	White	Intact	0.0
358	W Stair	B	Stairs	Rgt	Stringer	Metal	White	Intact	-0.3
359	W Stair	B	Door	Rgt	Lft casing	Metal	Gray	Intact	-0.1
360	W Stair	D	El Dr Pnl	Ctr		Metal	Red	Intact	-0.2
361	W Stair	D	Door	Rgt	U Ctr	Wood	Varnish	Intact	0.0
362	W Stair	B	Door	Rgt	U Ctr	Metal	Gray	Intact	-0.1
363	W Stair	C	Rad Cover	Rgt		Metal	Gray	Intact	0.0
364	W Stair	C	Wall	L Rgt		Drywall	White	Intact	0.0
365	W Stair	D	Wall	L Lft		Drywall	White	Intact	-0.1
366	W Stair	A	Wall	L Lft		Drywall	White	Intact	-0.2
367	W Stair	B	Wall	U Ctr		Drywall	White	Intact	-0.3
368	W Stair	B	Ceiling			Drywall	White	Intact	-0.1
369	Exterior	A	Railing	Rgt	Railing	Metal	Black	Intact	0.0
370	Exterior	A	Railing	Ctr	Railing	Metal	Black	Intact	0.0
371	Exterior	B	Lintel	Lft		Metal	Gray	Intact	-0.1
372	Exterior	B	Awning	Lft		Plaster	White	Intact	-0.1
373	Exterior	C	Lintel	Rgt		Metal	Gray	Intact	0.0
374	**Exterior**	**B**	**Curb**	**Rgt**		**Concrete**	**Yellow**	Intact	**2.4**
375	Calibration								0.7
376	Calibration								0.8
377	Calibration								0.7

No.	Location/ Room	Wall	Component			Substrate	Color	Condition	Reading (gm/cm^2)
			Structure	Location	Member				
1	Calibration								0.8
2	Calibration								0.7
3	Calibration								0.7
4	103	A	Door	Ctr	U Ctr	Metal	Beige	Intact	0.5
5	103	A	Door	Ctr	Rgt jamb	Metal	Beige	Intact	0.0
6	103	D	Cabinet	Rgt		Metal	Blue	Intact	-0.2
7	103	A	Elec Panel	Rgt		Metal	Gray	Intact	-0.3
8	103	A	Access Door	Rgt		Metal	White	Intact	-0.3
9	103	D	Hood	Ctr		Metal	White	Intact	0.0
10	103	C	Wall	U Ctr		Conc Block	White	Intact	0.2
11	103	D	Wall	U Lft		Concrete	White	Intact	0.2
12	103	A	Wall	U Lft		Concrete	White	Intact	0.2
13	103	B	Wall	U Lft		Concrete	White	Intact	-0.1
14	103	B	Ceiling			Concrete	White	Intact	-0.1
15	103	B	Floor			Concrete	Gray	Intact	-0.1
16	104	A	Wall	U Ctr		Concrete	Beige	Intact	-0.1
17	104	B	Wall	U Ctr		Concrete	Beige	Intact	0.0
18	104	C	Wall	U Ctr		Concrete	Beige	Intact	-0.3
19	104	D	Wall	U Lft		Concrete	Beige	Intact	-0.1
20	104	C	Wall	U Ctr		Conc Block	Beige	Intact	0.0
21	104	C	Cabinet	Rgt		Metal	Gray	Intact	0.0
22	104	A	Elec Panel	Lft		Metal	Gray	Intact	0.2
23	104	A	Door	Ctr	U Ctr	Metal	Beige	Intact	-0.1
24	104	A	Door	Ctr	Lft jamb	Metal	Beige	Intact	0.5
25	113	C	Door	Ctr	Lft casing	Metal	Beige	Intact	0.0
26	113	C	Door	Ctr	U Ctr	Metal	Beige	Intact	0.2
27	113	D	Cabinet	Ctr		Metal	Blue	Intact	0.0
28	113	D	Hood	Lft		Metal	Blue	Intact	0.0
29	113	C	Elec Panel	Ctr		Metal	Gray	Intact	0.1
30	113	A	Wall	L Rgt		Conc Block	Beige	Intact	0.0
31	113	B	Wall	L Lft		Conc Block	Beige	Intact	0.1
32	113	B	Wall	L Ctr		Concrete	Beige	Intact	0.2
33	113	C	Wall	U Lft		Concrete	Beige	Intact	0.0
34	113	D	Wall	L Lft		Concrete	Beige	Intact	0.0
35	113	A	Wall	U Rgt		Concrete	Beige	Intact	0.0
36	113	A	Ceiling			Concrete	Beige	Intact	0.0
37	112	A	Wall	U Ctr		Concrete	Beige	Intact	0.0
38	112	B	Wall	U Ctr		Concrete	Beige	Intact	0.2
39	112	C	Wall	U Ctr		Concrete	Beige	Intact	-0.1
40	112	D	Wall	U Ctr		Concrete	Beige	Intact	0.0
41	112	A	Hood	Lft		Metal	Beige	Intact	0.0
42	112	C	Door	Ctr	U Ctr	Metal	Beige	Intact	0.0
43	112	C	Door	Ctr	Rgt jamb	Metal	Beige	Intact	0.4
44	111	C	Door	Rgt	Lft casing	Metal	Beige	Intact	0.0

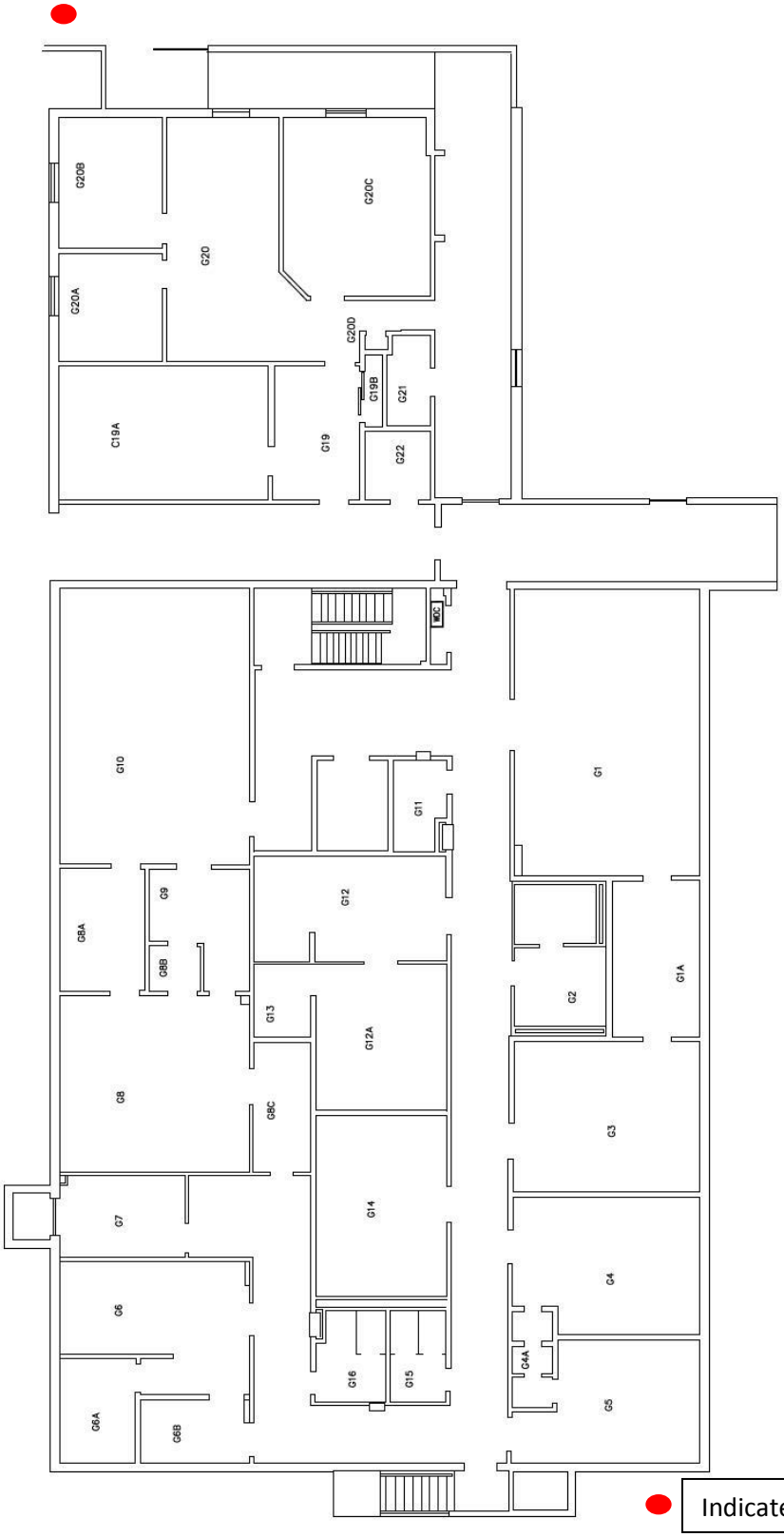
No.	Location/ Room	Wall	Component			Substrate	Color	Condition	Reading (gm/cm^2)
			Structure	Location	Member				
45	111	C	Door	Rgt	U Ctr	Metal	Beige	Intact	0.3
46	111	C	Elec Panel	Rgt		Metal	Beige	Intact	0.0
47	111	A	Wall	U Lft		Metal	Beige	Intact	-0.2
48	111	B	Cabinet	Lft		Metal	Blue	Intact	0.1
49	111	B	Hood	Lft		Metal	Blue	Intact	0.0
50	111	A	Window	Rgt	Sill	Concrete	Beige	Intact	0.0
51	111	A	Wall	L Rgt		Conc Block	Beige	Intact	-0.1
52	111	B	Wall	L Lft		Conc Block	Beige	Intact	0.1
53	111	C	Wall	U Lft		Conc Block	Beige	Intact	-0.1
54	111	A	Wall	L Ctr		Concrete	Beige	Intact	0.0
55	111	D	Wall	L Lft		Concrete	Beige	Intact	0.0
56	111	A	Wall	U Lft		Drywall	Beige	Intact	0.0
57	111A	C	Wall	U Ctr		Drywall	Beige	Intact	0.0
58	111A	B	Wall	U Lft		Drywall	Beige	Intact	0.0
59	111A	D	Wall	U Ctr		Drywall	Beige	Intact	0.2
60	111A	A	Wall	L Lft		Concrete	Beige	Intact	0.2
61	111A	A	Window	Lft	Sill	Concrete	Beige	Intact	0.1
62	111A	A	Wall	L Ctr		Conc Block	Beige	Intact	-0.1
63	111A	C	Door	Ctr	U Ctr	Metal	Beige	Intact	-0.2
64	111A	C	Door	Ctr	Rgt jamb	Metal	Beige	Intact	-0.1
65	G01	A	Door	Ctr	Rgt casing	Metal	Beige	Intact	0.0
66	G01	A	Wall	L Ctr		Drywall	Beige	Intact	-0.1
67	G01	B	Wall	L Ctr		Drywall	Beige	Intact	0.1
68	G01	C	Wall	L Ctr		Drywall	Beige	Intact	-0.1
69	G01	D	Wall	L Ctr		Drywall	Beige	Intact	-0.1
70	G01	A	Door	Ctr	U Ctr	Wood	Varnish	Intact	-0.2
71	G01A	A	Door	Lft	U Ctr	Wood	Varnish	Intact	0.0
72	G01A	A	Door	Lft	Lft casing	Metal	Beige	Intact	0.0
73	G01A	A	Wall	L Ctr		Drywall	Beige	Intact	-0.1
74	G01A	B	Wall	L Ctr		Drywall	Beige	Intact	-0.2
75	G01A	C	Wall	L Ctr		Drywall	Beige	Intact	0.0
76	G01A	D	Wall	L Ctr		Drywall	Beige	Intact	-0.1
77	G01B Office	D	Wall	U Lft		Drywall	Beige	Intact	0.0
78	G01B Office	C	Wall	U Ctr		Drywall	Beige	Intact	0.0
79	G01B Office	B	Wall	U Lft		Drywall	Beige	Intact	-0.1
80	G01B Office	A	Wall	U Ctr		Drywall	Beige	Intact	0.0
81	G01B Office	A	Door	Rgt	Rgt jamb	Metal	Beige	Intact	-0.2
82	G01B Office	A	Door	Rgt	U Ctr	Wood	Varnish	Intact	0.0
83	G03	D	Hood	Lft		Metal	Blue	Intact	-0.1
84	G03	D	Cabinet	Ctr		Metal	Blue	Intact	0.1
85	G03	A	Door	Lft	Rgt jamb	Metal	Beige	Intact	0.0
86	G03	A	Door	Lft	U Ctr	Wood	Beige	Intact	0.1

No.	Location/ Room	Wall	Component			Substrate	Color	Condition	Reading (gm/cm^2)
			Structure	Location	Member				
87	G03	A	Wall	L Rgt		Concrete	Beige	Intact	0.1
88	G03	B	Wall	L Lft		Concrete	Beige	Intact	0.0
89	G03	C	Wall	U Ctr		Concrete	Beige	Intact	0.4
90	G03	D	Wall	U Lft		Concrete	Beige	Intact	0.2
91	G03	C	Elec Panel	Rgt		Metal	Gray	Intact	-0.1
92	G04	C	Cabinet	Ctr		Metal	Blue	Intact	-0.1
93	G04	B	Hood	Ctr		Metal	Blue	Intact	-0.1
94	G04	A	Door	Ctr	Lft jamb	Metal	White	Intact	0.0
95	G04	A	Door	Ctr	U Ctr	Wood	White	Intact	0.1
96	G04	A	Wall	U Rgt		Concrete	White	Intact	0.3
97	G04	B	Wall	U Ctr		Concrete	White	Intact	0.0
98	G04	C	Wall	U Lft		Concrete	White	Intact	-0.1
99	G04	D	Wall	U Rgt		Concrete	White	Intact	0.2
100	G04	D	Closet	Rgt	Wall	Concrete	Yellow	Intact	0.3
101	G04	D	Closet	Rgt	Ceiling	Concrete	Yellow	Intact	0.1
102	G07 Chemical	A	Ceiling			Concrete	Yellow	Intact	-0.1
103	G07 Chemical	A	Wall	L Ctr		Concrete	Yellow	Intact	0.2
104	G07 Chemical	B	Wall	U Ctr		Concrete	Yellow	Intact	-0.1
105	G07 Chemical	D	Wall	U Ctr		Concrete	Yellow	Intact	-0.2
106	G07 Chemical	A	Wall	U Ctr		Conc Block	Yellow	Intact	-0.1
107	G07 Chemical	C	Wall	U Ctr		Metal	Yellow	Intact	-0.1
108	G07 Chemical	D	Wall	U Lft		Metal	Yellow	Intact	-0.1
109	G07 Chemical	C	Door	Rgt	Rgt casing	Metal	Yellow	Intact	-0.1
110	G07 Chemical	C	Door	Rgt	U Ctr	Wood	Red	Intact	-0.1
111	G12	C	Door	Ctr	U Ctr	Wood	Varnish	Intact	0.1
112	G12	B	Cabinet	Rgt		Metal	Yellow	Intact	0.1
113	G12	A	Hood	Ctr		Metal	White	Intact	-0.1
114	G12	C	Door	Ctr	Lft jamb	Metal	White	Intact	-0.3
115	G12	C	Wall	U Lft		Concrete	White	Intact	-0.1
116	G12	D	Wall	U Rgt		Concrete	White	Intact	-0.1
117	G12	A	Wall	U Ctr		Concrete	White	Intact	-0.3
118	G12	B	Wall	U Ctr		Drywall	White	Intact	-0.3
119	G13	B	Wall	U Ctr		Drywall	White	Intact	0.0
120	G13	C	Wall	U Lft		Concrete	White	Intact	-0.1
121	G13	D	Wall	U Ctr		Concrete	White	Intact	0.1
122	G13	A	Wall	U Rgt		Concrete	White	Intact	0.1
123	G13	A	Door	Rgt	Lft casing	Metal	White	Intact	-0.2
124	G13	A	Door	Rgt	U Ctr	Wood	Varnish	Intact	-0.1
125	G13A	C	Door	Lft	U Ctr	Wood	Varnish	Intact	0.1
126	G13A	C	Door	Lft	Rgt jamb	Metal	White	Intact	0.1
127	G13A	C	Wall	U Ctr		Concrete	White	Intact	0.0
128	G13A	B	Wall	U Ctr		Concrete	White	Intact	0.0
129	G13A	A	Wall	U Ctr		Concrete	White	Intact	-0.1
130	G13A	D	Wall	U Ctr		Concrete	White	Intact	-0.1
131	G13A	D	Hood	Ctr		Metal	Blue	Intact	0.0
132	G18A	C	Door	Ctr	Lft jamb	Metal	White	Intact	-0.1
133	G18A	C	Wall	L Lft		Drywall	White	Intact	0.0

No.	Location/ Room	Wall	Component			Substrate	Color	Condition	Reading (gm/cm^2)
			Structure	Location	Member				
134	G18A	D	Wall	L Lft		Drywall	White	Intact	0.2
135	G18A	A	Wall	L Lft		Conc Block	White	Intact	0.1
136	G18A	B	Wall	L Lft		Conc Block	White	Intact	0.0
137	G18A	C	Door	Ctr	U Ctr	Wood	Varnish	Intact	0.0
138	G19/23	C	Door	Rgt	U Ctr	Wood	Varnish	Intact	-0.3
139	G19/23	C	Closet	Ctr	Shelf Sup.	Wood	White	Intact	-0.3
140	G19/23	C	Closet	Ctr	Wall	Drywall	White	Intact	-0.1
141	G19/23	D	Wall	L Ctr		Drywall	Green	Intact	0.0
142	G19/23	B	Wall	L Ctr		Drywall	Blue	Intact	0.0
143	G19/23	A	Wall	U Rgt		Drywall	Yellow	Intact	-0.2
144	G19/23	C	Wall	U Rgt		Drywall	Yellow	Intact	-0.2
145	G19/23	C	Door	Rgt	Lft jamb	Metal	Yellow	Intact	0.0
146	G19E	C	Door	Rgt	Rgt jamb	Metal	Yellow	Intact	0.0
147	G19E	C	Wall	U Rgt		Drywall	Yellow	Intact	0.0
148	G19E	D	Wall	L Ctr		Drywall	Yellow	Intact	0.0
149	G19E	A	Wall	L Lft		Drywall	Yellow	Intact	0.0
150	G19E	B	Wall	L Ctr		Drywall	Yellow	Intact	-0.1
151	G19E	C	Door	Rgt	U Ctr	Wood	Varnish	Intact	-0.1
152	G19D	C	Door	Lft	U Ctr	Wood	Varnish	Intact	0.0
153	G19D	C	Door	Lft	Lft jamb	Metal	Yellow	Intact	-0.2
154	G19D	C	Wall	U Ctr		Drywall	Yellow	Intact	-0.2
155	G19D	D	Wall	U Ctr		Drywall	Yellow	Intact	-0.1
156	G19D	A	Wall	U Ctr		Drywall	Yellow	Intact	-0.1
157	G19D	B	Wall	U Ctr		Drywall	Yellow	Intact	0.0
158	G20B	A	Wall	U Ctr		Drywall	Yellow	Intact	0.0
159	G20B	B	Wall	U Ctr		Drywall	Yellow	Intact	-0.1
160	G20B	C	Wall	U Ctr		Drywall	Yellow	Intact	-0.2
161	G20B	D	Wall	U Ctr		Drywall	Yellow	Intact	-0.3
162	G20B	D	Door	Lft	Lft jamb	Metal	Yellow	Intact	0.0
163	G20B	D	Door	Lft	U Ctr	Wood	Varnish	Intact	0.1
164	G20A	D	Door	Lft	U Ctr	Wood	Varnish	Intact	0.0
165	G20A	D	Door	Lft	Rgt jamb	Metal	Yellow	Intact	-0.1
166	G20A	D	Wall	L Ctr		Drywall	Yellow	Intact	-0.1
167	G20A	C	Wall	U Ctr		Drywall	Yellow	Intact	0.0
168	G20A	B	Wall	U Ctr		Drywall	Yellow	Intact	-0.1
169	G20A	A	Wall	U Ctr		Drywall	Yellow	Intact	-0.1
170	G20C	A	Wall	U Ctr		Drywall	Yellow	Intact	-0.3
171	G20C	B	Wall	U Ctr		Drywall	Yellow	Intact	-0.2
172	G20C	C	Wall	U Ctr		Drywall	Yellow	Intact	-0.1
173	G20C	D	Wall	U Ctr		Drywall	Yellow	Intact	-0.1
174	G20C	D	Door	Rgt	Lft casing	Metal	Yellow	Intact	0.0
175	G20C	D	Door	Rgt	U Ctr	Wood	Varnish	Intact	0.0

No.	Location/ Room	Wall	Component			Substrate	Color	Condition	Reading (gm/cm^2)
			Structure	Location	Member				
176	G20E	D	Door	Rgt	U Ctr	Wood	Varnish	Intact	0.1
177	G20E	D	Door	Rgt	Rgt casing	Metal	Yellow	Intact	-0.1
178	G20E	D	Wall	U Ctr		Drywall	Yellow	Intact	-0.2
179	G20E	C	Wall	U Ctr		Drywall	Yellow	Intact	0.0
180	G20E	B	Wall	U Ctr		Drywall	Yellow	Intact	0.0
181	G20E	A	Wall	U Ctr		Drywall	Yellow	Intact	-0.2
182	G19 Toilet	D	Door	Ctr	Lft jamb	Metal	Beige	Intact	0.3
183	G19 Toilet	D	Door	Ctr	U Ctr	Wood	Varnish	Intact	0.4
184	Calibration								0.7
185	Calibration								0.7
186	Calibration								0.8
1630	Calibration								1
1631	Calibration								1.1
1632	Calibration								0.9
1633	Calibration								0.9
1717	**Curb**				**Painted**	**Concrete**	**Yellow**	**DETERIORATED**	**2.4**
1718	**Curb**				**Painted**	**Concrete**	**Yellow**	**DETERIORATED**	**2.7**
1719	Calibration								1.1
1720	Calibration								1.2
1721	Calibration								1

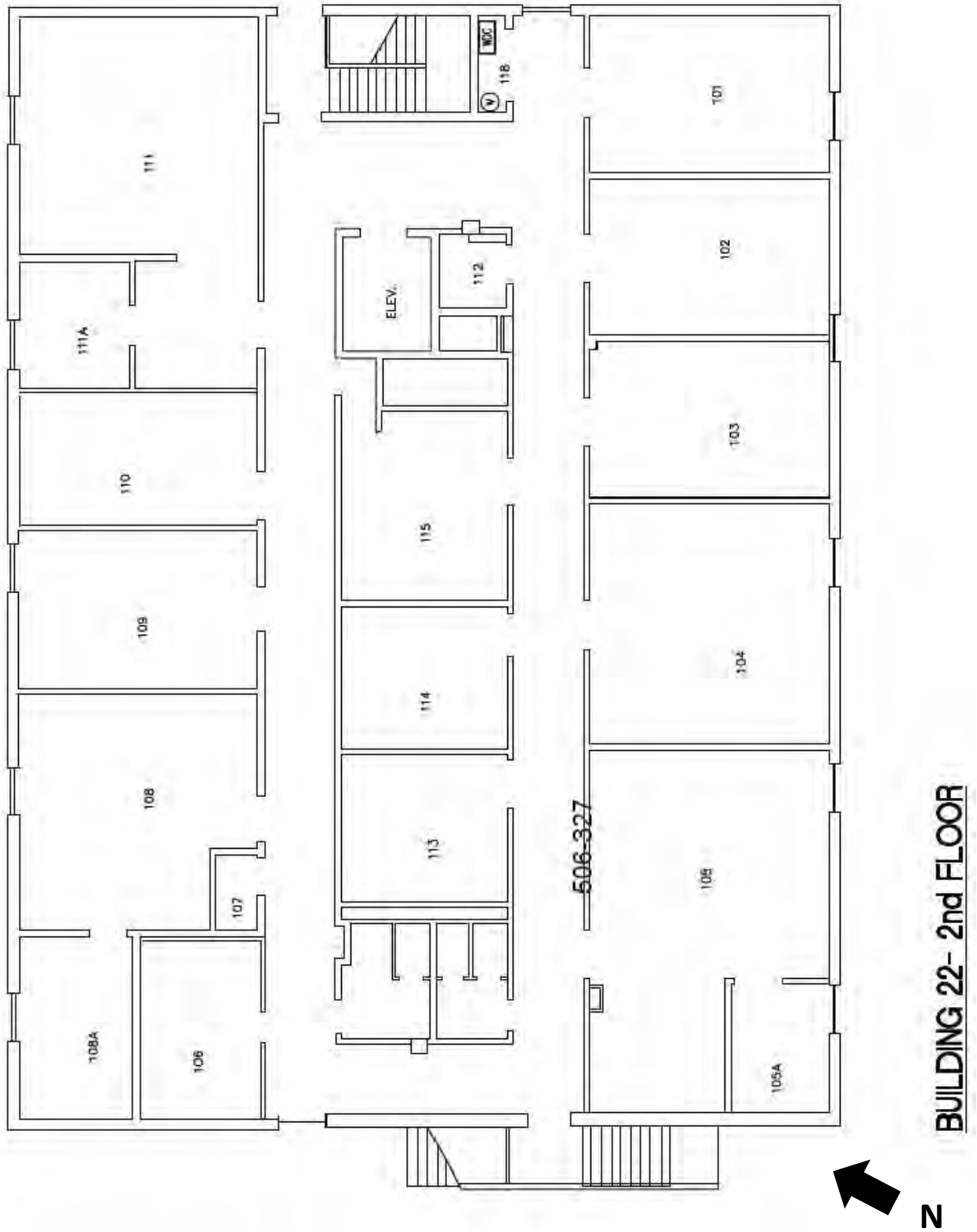
Appendix 2 – Building Schematics (Positive LBP Locations)



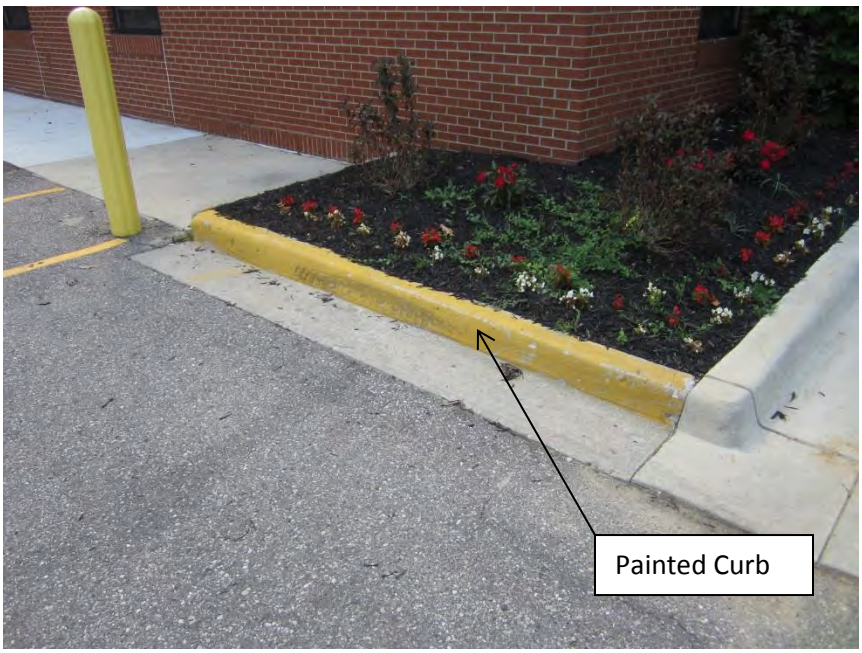
BUILDING 22 – 1ST FLOOR

N

Indicates positive LBP test results.


BUILDING 22- 2nd FLOOR
N
506-327
101
102
103
104
105
105A
106
107
108
108A
109
110
111
111A
112
113
114
115
118
ELEV.
WOC

Appendix 3 – Photographs



Photograph PB 1 – Painted Curb with LBP (Northwest corner Bldg. 22)

Photograph PB 2 – Painted Curbs with LBP (Access lane South of Bldg. 22)

Appendix 4 – Inspector Certifications

STATE OF MICHIGAN
DEPARTMENT OF COMMUNITY HEALTH
LANSING

RICK SNYDER
GOVERNOR

JAMES K. HAVEMAN
DIRECTOR

July 28, 2014

Dear Lead Professional:

Your application for certification as a Lead Professional with the Michigan Department of Community Health, Healthy Homes Section (HHS) has been approved.

This certification is issued to you as evidence that you have met or exceeded the minimum requirements of the Michigan Lead Abatement Act for the discipline indicated, and have successfully passed the certification examination, and paid the appropriate fee. The enclosed certification card is valid until **March 31, 2015**, whereupon the annual fee is due. Certification is valid for a period of three (3) years. Your application for renewal must include evidence that you have successfully completed an accredited refresher lead training course, and be submitted within 45 days prior to the expiration date.

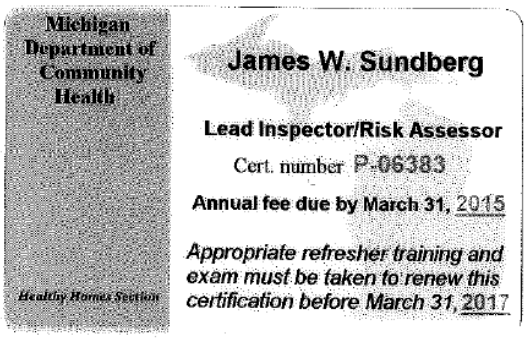
The certification card must be present with you at any site where you are conducting lead-based paint activities.

As you have been advised and previously agreed to on the Lead Professional Certification Application, compliance with all applicable federal, state, and local regulations, ordinances, guidelines, and laws remains a condition of certification. Violations will result in suspension or revocation of certification, and/or citation and administrative fine. If you have any questions regarding lead-based paint activities, please contact our office at (517) 335-8385.

Congratulations on your certification,
HEALTHY HOMES SECTION

Jay A. Wagar
Certification and Compliance Officer

Encl: *Lead Professional Certification Card*



DCH-1272 (08/12) (W)

CAPITOL VIEW BUILDING • 201 TOWNSEND STREET • LANSING, MICHIGAN 48913
www.michigan.gov • (517) 373-3740

STATE OF MICHIGAN
DEPARTMENT OF COMMUNITY HEALTH
LANSING

RICK SNYDER
GOVERNOR

JAMES K. HAVEMAN
DIRECTOR

February 25, 2014

Dear Certified Lead Professional:

Your annual update application for certification with the Michigan Department of Community Health, Healthy Homes Section (HHS) has been approved.

This certification is issued to you as evidence that you have met or exceeded the minimum requirements of the Michigan Lead Abatement Act for the discipline indicated, and have successfully passed the certification examination, and paid the appropriate fee. The enclosed certification card is valid until **March 31, 2015**, whereupon the annual fee is due. Certification is valid for a period of three (3) years. Your application for renewal must include evidence that you have successfully completed an accredited refresher lead training course, and be submitted within 45 days prior to the expiration date. The State Lead Examination must also be taken.

The certification card must be present with you at any site where you are conducting lead-based paint activities.

As you have been advised and previously agreed to on the Lead Professional Certification Application, compliance with all applicable federal, state, and local regulations, ordinances, guidelines, and laws remains a condition of certification. Violations will result in suspension or revocation of certification, and/or citation and administrative fine. If you have any questions regarding lead-based paint activities, please contact our office at (517) 241-8436.

Congratulations on your certification,

HEALTHY HOMES SECTION

Nicole Sparrow
Certification Assistant

Encl: *Lead Professional Certification Card*

Douglas Haase

Inspector/Risk Assessor

Cert. number P-00383

Annual fee due by March 31, 2015

Appropriate refresher training and exam must be taken to renew this certification before March 31, 2017

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Michigan Department of Community Health
Healthy Homes Section
Dennis Karl
Lead Inspector/Risk Assessor
Cert. number P-06358
Annual fee due by March 31, 2015
Appropriate refresher training and exam must be taken to renew this certification before March 31, 2017

Appendix 5 – USEPA PCS

Performance Characteristic Sheet

EFFECTIVE DATE: **December 1, 2006** **EDITION NO.: 5**

MANUFACTURER AND MODEL:

Make: ***Radiation Monitoring Devices***
Model: ***LPA-1***
Source: ***^{57}Co***
Note: This sheet supersedes all previous sheets for the XRF instrument of the make, model, and source shown above ***for instruments sold or serviced after June 26, 1995. For other instruments, see prior editions.***

FIELD OPERATION GUIDANCE

OPERATING PARAMETERS:

Quick mode or 30-second equivalent standard (Time Corrected) mode readings.

XRF CALIBRATION CHECK LIMITS:

0.7 to 1.3 mg/cm^2 (inclusive)

SUBSTRATE CORRECTION:

For XRF results below 4.0 mg/cm^2, substrate correction is recommended for:

Metal using 30-second equivalent standard (Time Corrected) mode readings.
None using quick mode readings.

Substrate correction is not needed for:

Brick, Concrete, Drywall, Plaster, and Wood using 30-second equivalent standard (Time Corrected) mode readings
Brick, Concrete, Drywall, Metal, Plaster, and Wood using quick mode readings

THRESHOLDS:

30-SECOND EQUIVALENT STANDARD MODE READING DESCRIPTION	SUBSTRATE	THRESHOLD (mg/cm^2)
Results corrected for substrate bias on metal substrate only	Brick	1.0
	Concrete	1.0
	Drywall	1.0
	Metal	0.9
	Plaster	1.0
	Wood	1.0

QUICK MODE READING DESCRIPTION	SUBSTRATE	THRESHOLD (mg/cm^2)
Readings not corrected for substrate bias on any substrate	Brick	1.0
	Concrete	1.0
	Drywall	1.0
	Metal	1.0
	Plaster	1.0
	Wood	1.0

BACKGROUND INFORMATION

EVALUATION DATA SOURCE AND DATE:

This sheet is supplemental information to be used in conjunction with Chapter 7 of the HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* ("HUD Guidelines"). Performance parameters shown on this sheet are calculated from the EPA/HUD evaluation using archived building components. Testing was conducted on approximately 150 test locations in July 1995. The instrument that performed testing in September had a new source installed in June 1995 with 12 mCi initial strength.

OPERATING PARAMETERS:

Performance parameters shown in this sheet are applicable only when properly operating the instrument using the manufacturer's instructions and procedures described in Chapter 7 of the HUD Guidelines.

XRF CALIBRATION CHECK:

The calibration of the XRF instrument should be checked using the paint film nearest 1.0 mg/cm^2 in the NIST Standard Reference Material (SRM) used (e.g., for NIST SRM 2579, use the 1.02 mg/cm^2 film).

If readings are outside the acceptable calibration check range, follow the manufacturer's instructions to bring the instruments into control before XRF testing proceeds.

SUBSTRATE CORRECTION VALUE COMPUTATION :

Chapter 7 of the HUD Guidelines provides guidance on correcting XRF results for substrate bias. Supplemental guidance for using the paint film nearest 1.0 mg/cm^2 for substrate correction is provided:

XRF results are corrected for substrate bias by subtracting from each XRF result a correction value determined separately in each house for single-family housing or in each development for multifamily housing, for each substrate. The correction value is an average of XRF readings taken over the NIST SRM paint film nearest to 1.0 mg/cm^2 at test locations that have been scraped bare of their paint covering. Compute the correction values as follows:

> Using the same XRF instrument, take three readings on a <u>bare</u> substrate area covered with the NIST SRM paint film nearest 1 mg/cm^2. Repeat this procedure by taking three more readings on a second <u>bare</u> substrate area of the same substrate covered with the NIST SRM.
>
> Compute the correction value for each substrate type where XRF readings indicate substrate correction is needed by computing the average of all six readings as shown below.
>
> For each substrate type (the 1.02 mg/cm^2 NIST SRM is shown in this example; use the actual lead loading of the NIST SRM used for substrate correction):
>
> $$\text{Correction value} = (1^{st} + 2^{nd} + 3^{rd} + 4^{th} + 5^{th} + 6^{th}\ \textit{Reading}) / 6 - 1.02\ \text{mg/cm}^2$$
>
> Repeat this procedure for each substrate requiring substrate correction in the house or housing development.

EVALUATING THE QUALITY OF XRF TESTING:

Randomly select ten testing combinations for retesting from each house or from two randomly selected units in multifamily housing. Use either the Quick Mode or 30-second equivalent standard (Time Corrected) Mode readings.

Conduct XRF re-testing at the ten testing combinations selected for retesting.

Determine if the XRF testing in the units or house passed or failed the test by applying the steps below.

Compute the Retest Tolerance Limit by the following steps:

Determine XRF results for the original and retest XRF readings. Do not correct the original or retest results for substrate bias. In single-family and multi-family housing, a result is defined as a single reading. Therefore, there will be ten original and ten retest XRF results for each house or for the two selected units.

Calculate the average of the original XRF result and retest XRF result for each testing combination.

Square the average for each testing combination.

Add the ten squared averages together. Call this quantity C.

Multiply the number C by 0.0072. Call this quantity D.

Add the number 0.032 to D. Call this quantity E.

Take the square root of E. Call this quantity F.

Multiply F by 1.645. The result is the Retest Tolerance Limit.

Compute the average of all ten original XRF results.

Compute the average of all ten re-test XRF results.

Find the absolute difference of the two averages.

If the difference is less than the Retest Tolerance Limit, the inspection has passed the retest. If the difference of the overall averages equals or exceeds the Retest Tolerance Limit, this procedure should be repeated with ten new testing combinations. If the difference of the overall averages is equal to or greater than the Retest Tolerance Limit a second time, then the inspection should be considered deficient.

Use of this procedure is estimated to produce a spurious result approximately 1% of the time. That is, results of this procedure will call for further examination when no examination is warranted in approximately 1 out of 100 dwelling units tested.

BIAS AND PRECISION:

Do not use these bias and precision data to correct for substrate bias. These bias and precision data were computed without substrate correction from samples with reported laboratory results less than 4.0 mg/cm^2 lead. The data which were used to determine the bias and precision estimates given in the table below have the following properties. During the July 1995 testing, there were 15 test locations with a laboratory-reported result equal to or greater than 4.0 mg/cm^2 lead. Of these, one 30-second standard mode reading was less than 1.0 mg/cm^2 and none of the quick mode readings were less than 1.0 mg/cm^2. The instrument that tested in July is representative of instruments sold or serviced after June 26, 1995. These data are for illustrative purposes only. Actual bias must be determined on the site. Results provided above already account for bias and precision. Bias and precision ranges are provided to show the variability found between machines of the same model.

30-SECOND STANDARD MODE READING MEASURED AT	SUBSTRATE	BIAS (mg/cm^2)	PRECISION* (mg/cm^2)
0.0 mg/cm^2	Brick	0.0	0.1
	Concrete	0.0	0.1
	Drywall	0.1	0.1
	Metal	0.3	0.1
	Plaster	0.1	0.1
	Wood	0.0	0.1
0.5 mg/cm^2	Brick	0.0	0.2
	Concrete	0.0	0.2
	Drywall	0.0	0.2
	Metal	0.2	0.2
	Plaster	0.0	0.2
	Wood	0.0	0.2
1.0 mg/cm^2	Brick	0.0	0.3
	Concrete	0.0	0.3
	Drywall	0.0	0.3
	Metal	0.2	0.3
	Plaster	0.0	0.3
	Wood	0.0	0.3
2.0 mg/cm^2	Brick	-0.1	0.4
	Concrete	-0.1	0.4
	Drywall	-0.1	0.4
	Metal	0.1	0.4
	Plaster	-0.1	0.4
	Wood	-0.1	0.4

*Precision at 1 standard deviation.

CLASSIFICATION RESULTS:

XRF results are classified as positive if they are greater than the upper boundary of the inconclusive range, and negative if they are less than the lower boundary of the inconclusive range, or inconclusive if in between. The inconclusive range includes both its upper and lower bounds. Earlier editions of this *XRF Performance Characteristic Sheet* did not include both bounds of the inconclusive range as "inconclusive." While this edition of the Performance Characteristics Sheet uses a different system, the specific XRF readings that are considered positive, negative, or inconclusive for a given XRF model and substrate remain unchanged, so previous inspection results are not affected.

DOCUMENTATION:

An EPA document titled *Methodology for XRF Performance Characteristic Sheets* provides an explanation of the statistical methodology used to construct the data in the sheets, and provides empirical results from using the recommended inconclusive ranges or thresholds for specific XRF instruments. For a copy of this document call the National Lead Information Center Clearinghouse at 1-800-424-LEAD. A HUD document titled *A Nonparametric Method for Estimating the 5th and 95th Percentile Curves of Variable-Time XRF Readings Based on Monotone Regression* provides supplemental information on the methodology for variable-time XRF instruments. A copy of this document can be obtained from the HUD lead web site, www.hud.gov/offices/lead.

This XRF Performance Characteristic Sheet was developed by QuanTech, Inc., under a contract from the U.S. Department of Housing and Urban Development (HUD). HUD has determined that the information provided here is acceptable when used as guidance in conjunction with Chapter 7, Lead-Based Paint Inspection, of HUD's *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*.

Niton XLp 300, 9/24/2004, ed. 1

Performance Characteristic Sheet

EFFECTIVE DATE: **September 24, 2004** **EDITION NO.: 1**

MANUFACTURER AND MODEL:

Make: *Niton LLC*
Tested Model: *XLp 300*
Source: ^{109}Cd
Note: This PCS is also applicable to the equivalent model variations indicated below, for the Lead-in-Paint K+L variable reading time mode, in the XLi and XLp series:

XLi 300A, XLi 301A, XLi 302A and XLi 303A.
XLp 300A, XLp 301A, XLp 302A and XLp 303A.
XLi 700A, XLi 701A, XLi 702A and XLi 703A.
XLp 700A, XLp 701A, XLp 702A, and XLp 703A.

Note: The XLi and XLp versions refer to the shape of the handle part of the instrument. The differences in the model numbers reflect other modes available, in addition to Lead-in-Paint modes. The manufacturer states that specifications for these instruments are identical for the source, detector, and detector electronics relative to the Lead-in-Paint mode.

FIELD OPERATION GUIDANCE

OPERATING PARAMETERS:

Lead-in-Paint K+L variable reading time mode.

XRF CALIBRATION CHECK LIMITS:

0.8 to 1.2 mg/cm^2 (inclusive)

The calibration of the XRF instrument should be checked using the paint film nearest 1.0 mg/cm^2 in the NIST Standard Reference Material (SRM) used (e.g., for NIST SRM 2579, use the 1.02 mg/cm^2 film).

If readings are outside the acceptable calibration check range, follow the manufacturer's instructions to bring the instruments into control before XRF testing proceeds.

SUBSTRATE CORRECTION:

For XRF results using Lead-in-Paint K+L variable reading time mode, substrate correction is not needed for:

Brick, Concrete, Drywall, Metal, Plaster, and Wood

INCONCLUSIVE RANGE OR THRESHOLD:

K+L MODE READING DESCRIPTION	SUBSTRATE	THRESHOLD (mg/cm^2)
Results not corrected for substrate bias on any substrate	Brick	1.0
	Concrete	1.0
	Drywall	1.0
	Metal	1.0
	Plaster	1.0
	Wood	1.0

BACKGROUND INFORMATION

EVALUATION DATA SOURCE AND DATE:

This sheet is supplemental information to be used in conjunction with Chapter 7 of the HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* ("HUD Guidelines"). Performance parameters shown on this sheet are calculated from the EPA/HUD evaluation using archived building components. Testing was conducted in August 2004 on 133 testing combinations. The instruments that were used to perform the testing had new sources; one instrument's was installed in November 2003 with 40 mCi initial strength, and the other's was installed June 2004 with 40 mCi initial strength.

OPERATING PARAMETERS:

Performance parameters shown in this sheet are applicable only when properly operating the instrument using the manufacturer's instructions and procedures described in Chapter 7 of the HUD Guidelines.

SUBSTRATE CORRECTION VALUE COMPUTATION:

Substrate correction is not needed for brick, concrete, drywall, metal, plaster or wood when using Lead-in-Paint K+L variable reading time mode, the normal operating mode for these instruments. If substrate correction is desired, refer to Chapter 7 of the HUD Guidelines for guidance on correcting XRF results for substrate bias.

EVALUATING THE QUALITY OF XRF TESTING:

Randomly select ten testing combinations for retesting from each house or from two randomly selected units in multifamily housing. Use the K+L variable time mode readings.

Conduct XRF retesting at the ten testing combinations selected for retesting.

Determine if the XRF testing in the units or house passed or failed the test by applying the steps below.

Compute the Retest Tolerance Limit by the following steps:

Determine XRF results for the original and retest XRF readings. Do not correct the original or retest results for substrate bias. In single-family housing a result is defined as the average of three readings. In multifamily housing, a result is a single reading. Therefore, there will be ten original and ten retest XRF results for each house or for the two selected units.

Calculate the average of the original XRF result and retest XRF result for each testing combination.

Square the average for each testing combination.

Add the ten squared averages together. Call this quantity C.

Multiply the number C by 0.0072. Call this quantity D.

Add the number 0.032 to D. Call this quantity E.

Take the square root of E. Call this quantity F.

Multiply F by 1.645. The result is the Retest Tolerance Limit.

Compute the average of all ten original XRF results.

Compute the average of all ten re-test XRF results.

Find the absolute difference of the two averages.

If the difference is less than the Retest Tolerance Limit, the inspection has passed the retest. If the difference of the overall averages equals or exceeds the Retest Tolerance Limit, this procedure should be repeated with ten new testing combinations. If the difference of the overall averages is equal to or greater than the Retest Tolerance Limit a second time, then the inspection should be considered deficient.

Use of this procedure is estimated to produce a spurious result approximately 1% of the time. That is, results of this procedure will call for further examination when no examination is warranted in approximately 1 out of 100 dwelling units tested.

TESTING TIMES:

For the Lead-in-Paint K+L variable reading time mode, the instrument continues to read until it is moved away from the testing surface, terminated by the user, or the instrument software indicates the reading is complete. The following table provides testing time information for this testing mode. The times have been adjusted for source decay, normalized to the initial source strengths as noted above. Source strength and type of substrate will affect actual testing times. At the time of testing, the instruments had source strengths of 26.6 and 36.6 mCi.

Testing Times Using K+L Reading Mode (Seconds)						
	All Data			Median for laboratory-measured lead levels (mg/cm^2)		
Substrate	25th Percentile	Median	75th Percentile	Pb < 0.25	0.25 ≤ Pb<1.0	1.0 ≤ Pb
Wood Drywall	4	11	19	11	15	11
Metal	4	12	18	9	12	14
Brick Concrete Plaster	8	16	22	15	18	16

CLASSIFICATION RESULTS:

XRF results are classified as positive if they are greater than or equal to the threshold, and negative if they are less than the threshold.

DOCUMENTATION:

A document titled *Methodology for XRF Performance Characteristic Sheets* provides an explanation of the statistical methodology used to construct the data in the sheets, and provides empirical results from using the recommended inconclusive ranges or thresholds for specific XRF instruments. For a copy of this document call the National Lead Information Center Clearinghouse at 1-800-424-LEAD.

This XRF Performance Characteristic Sheet was developed by the Midwest Research Institute (MRI) and QuanTech, Inc., under a contract between MRI and the XRF manufacturer. HUD has determined that the information provided here is acceptable when used as guidance in conjunction with Chapter 7, Lead-Based Paint Inspection, of HUD's *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*.

ELEVATED
TECHNOLOGIES INC.

TRANSMITTAL

DATE 2/3/2025			**TRANSMITTAL NO.** 14 21 00-1
FROM: Elevated Technologies Inc.	**TO:** Department of Veterans Affairs Network Contracting Office (NCO) 10 24 Frank Lloyd Wright Drive Ann Arbor, MI 48105	**CONTRACT NO.** 36C25025C0026	**CHECK ONE:** (●) THIS IS A NEW TRANSMITTAL ( ) THIS IS A RESUBMITTAL OF TRANSMITTAL:
RSN: 14 21 00	**PROJECT TITLE & LOCATION:** 506-25-501 S4 Repairs		**THESE ARE TRANSMITTED:** For Your Approval

RSN	ITEM NO.	# OF SETS	DESCRIPTION OF SUBMITTAL ITEM	SUBMITTAL TYPE CODE	# OF COPIES	RESPONSIBLE CODE	
						CO	COR
14 21 00	1	1	Shop Drawings - Traction Machine	SD-02 SHOP DRAWINGS	1	0	1
14 21 00	2	1	Product Data - Traction Machine (Electrical)	SD-03 PRODUCT DATA	1	0	1
14 21 00	3	1	Product Data - Traction Machine	SD-03 PRODUCT DATA	1	0	1
14 21 00	4	1	Product Data - Controller	SD-03 PRODUCT DATA	1	0	1
14 21 00	5	1	Shop Drawings - Cab	SD-02 SHOP DRAWINGS	1	0	1
14 21 00	6	1	Shop Drawings - Fixtures	SD-02 SHOP DRAWINGS	1	0	1
14 21 00	7	1	Product Data - Ropes	SD-03 PRODUCT DATA	1	0	1
14 21 00	8	1	Product Data - Door Operator	SD-03 PRODUCT DATA	1	0	1
14 21 00	9	1	Product Data - Roller Guides	SD-03 PRODUCT DATA	1	0	1
14 21 00	10	1	Product Data - Traveling Cable	SD-03 PRODUCT DATA	1	0	1

REMARKS

I certify that the above submitted items had been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.

Ben Lehnerer Project Manager Elevated Technologies Inc.	
NAME OF CONTRACTOR	**SIGNATURE OF CONTRACTOR**

3-2072-5075

Imperial dual coil brake data

All values are per coil.	CSZ-15000D
Model	Frame 570XL
Pick Voltage Max.	230 VDC/COIL
Pick Voltage	200 VDC/COIL
Pick Current amps (per coil)	4 AMPS/COIL
Pick Duration:	1 Sec Max
Hold Voltage	100 VDC/COIL
Hold Current amps (per coil)	2 amps/coil
Cold Resistance (per coil)	48 ohms/ COIL
Hot Resistance (per coil)	59 ohms/ COIL
Hold torque (ft-lbs) per shoe	3190 ft-lbs
Cold resistance (per coil) measured at 25°C (77°F).	

This rating table is for 45% CWT

Live Load Lbs.	Feet per Min.	Sheave Diameter Inches	Rated Torque Ft-Lb.	Acceleration Torque Ft-Lb.	Total Torque Ft-Lb.	Motor Frame	Hp.	RPM	Rated HZ	Rated Motor Volts	Rated Amps	Peak Amps	Peak Drive Volts	Heat Output (BTU/hr)
6000	500	20.47	1655	3065	4720	570XL	58.8	187	31.1	382	76	216	437	4992

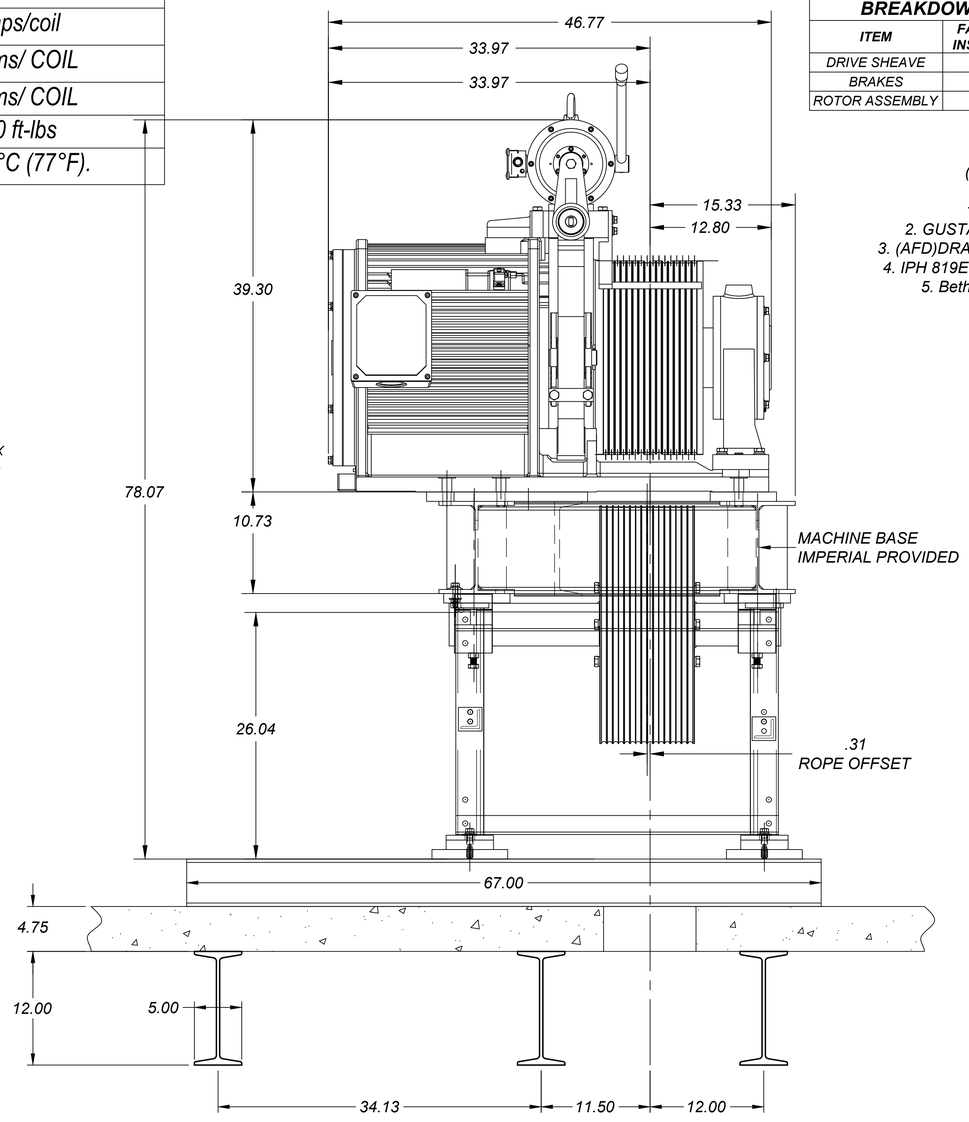
NOTE:
THE STATIC LOADS (RL1 , RL2) SHOWN IN THE TABLE ARE BASED ON A MAXIMUM SHEAVE SHAFT LOAD & MOTOR WEIGHT AS LISTED IN TABLE.

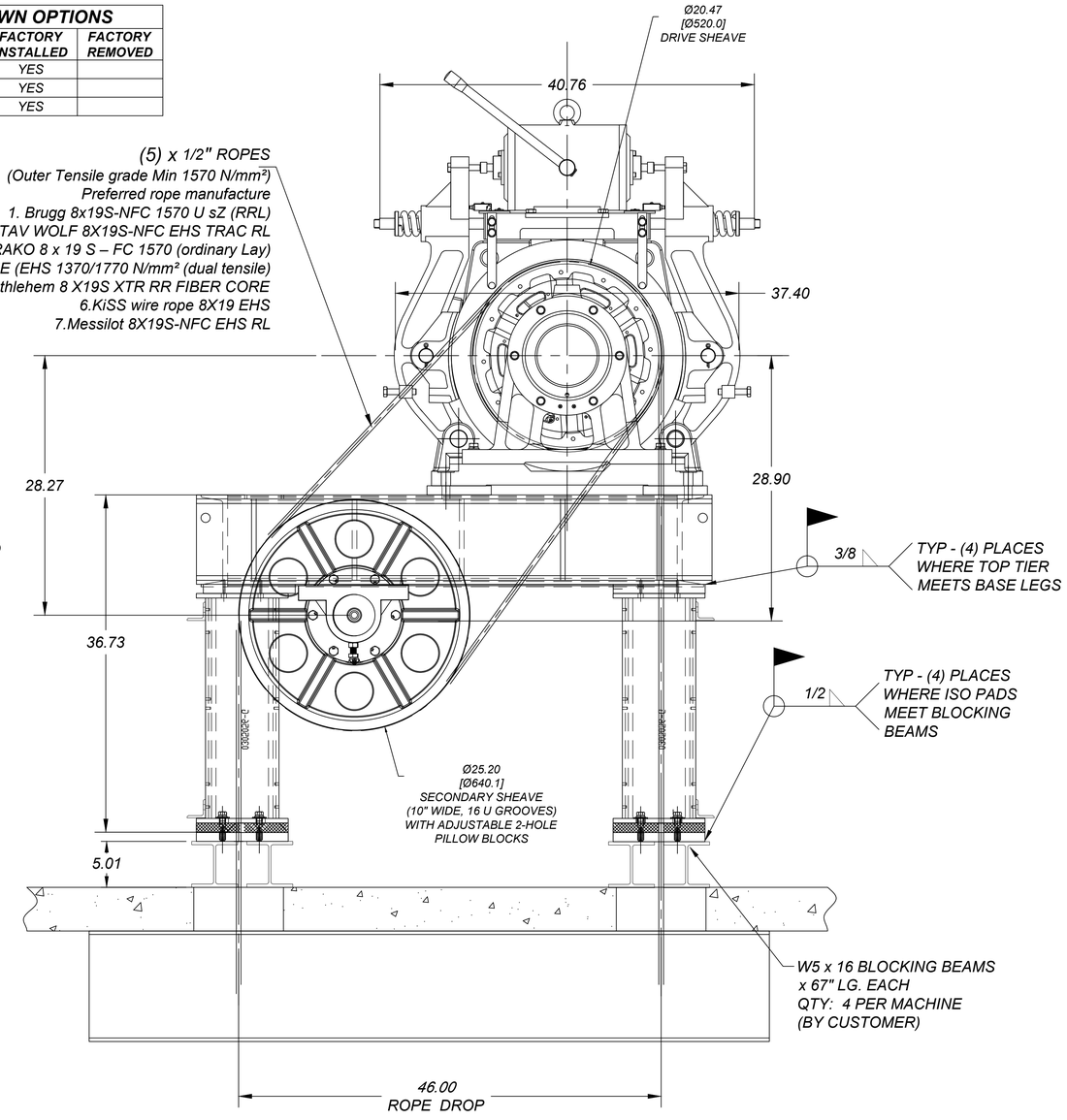
FRAME 570XL-OB WEIGHTS
COMPLETE MOTOR WEIGHT: 3950 LB APPX
MACHINE BASE WEIGHT: 1250 LBS APPX
SECONDARY SHEAVE WEIGHT: 625 LB APPX

TOTAL WEIGHT ABOVE FFL : 5825 lbs Appx

EMPTY CAR WEIGHT: 7,300 lbs.
BLDG. POWER SUPPLY: 480V

BREAKDOWN OPTIONS		
ITEM	FACTORY INSTALLED	FACTORY REMOVED
DRIVE SHEAVE	YES	
BRAKES	YES	
ROTOR ASSEMBLY	YES	





LEFT HAND SWING SHOWN

CUSTOMER JOB DATA	
JOB NAME	AAVA
LIVE LOAD	6000 lbs.
ROPING	2:1
VEL.(FT/MIN)	500 fpm
% CWT.	45%
TRAVEL	100' - 5"
WRAP ANGLE	311°
COMPENSATION	N/A
SUSPENDED LOAD	24,320 bs.
CAR No.	S4

FRAME SIZE	RL_1	RL_2	SHEAVE SHAFT LOAD (MAX.)	M/C WEIGHT (LBS.)
570XL	(MAX LBS./FOOT)		50000 LBS	3850

CUSTOMER NAME MCE-Elevator Service, LLC CUSTOMER ORDER NO. _____ IMPERIAL ELEC. ORDER NO. MPEG20829

FRAME 570XL HP 58.8 RPM 187 VOLTS 382 AMPS 76 MOTOR MODEL 570EAG058KXXX

DRAWING SHEET 1 OF 2

THIRD ANGLE PROJECTION

This print is the property of The Imperial Electric Company, and is loaned to the vendor, customer, or lender for inspection and/or approval. It is subject to return upon request.

ALL DIMENSIONS MUST BE HELD WITHIN:
X.XXX ±.005 [0.127]
X.XX ±.010 [0.254]
X.X ±.015 [0.381]
X ±1°
UNLESS OTHERWISE NOTED.

REV.	ECN NO.	DATE	APPR.
A	REF. 5061	01-28-25	JRM

IMPERIAL ELECTRIC — The Driving Force in Motion
THE IMPERIAL ELECTRIC COMPANY
Akron, Ohio 44306
DRWG. SIZE D
DESCRIPTION: AC GEARLESS 570XL FRM, 1/2" CABLE 20.5" SHEAVE U GROOVES LT DWT
DRWN. BY: JRM DATE: 01-28-2025
SCALE: NONE
CHK. BY: VM
DRWG. # 3-2072-5075
REV. A

3-2072-5075

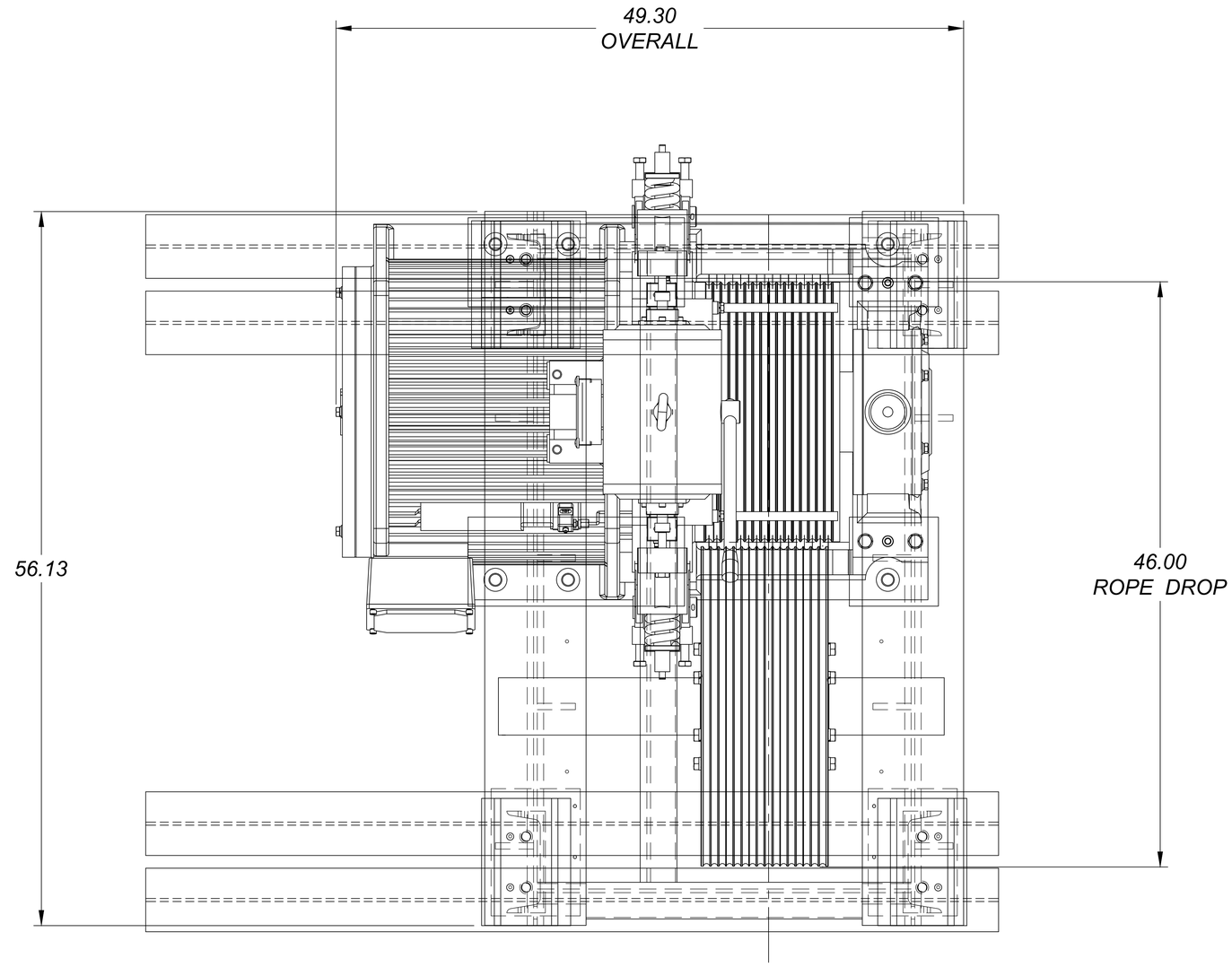
Imperial dual coil brake data

All values are per coil.	CSZ-15000D
Model	Frame 570XL
Pick Voltage Max.	230 VDC/COIL
Pick Voltage	200 VDC/COIL
Pick Current amps (per coil)	4 AMPS/COIL
Pick Duration:	1 Sec Max
Hold Voltage	100 VDC/COIL
Hold Current amps (per coil)	2 amps/coil
Cold Resistance (per coil)	48 ohms/ COIL
Hot Resistance (per coil)	59 ohms/ COIL
Hold torque (ft-lbs) per shoe	3190 ft-lbs
Cold resistance (per coil) measured at 25°C (77°F).	

This rating table is for 45% CWT

Live Load Lbs.	Feet per Min.	Sheave Diameter Inches	Rated Torque Ft-Lb.	Acceleration Torque Ft-Lb.	Total Torque Ft-Lb.	Motor Frame	Hp.	RPM	Rated HZ	Rated Motor Volts	Rated Amps	Peak Amps	Peak Drive Volts	Heat Output (BTU/hr)
6000	500	20.47	1655	3065	4720	570XL	58.8	187	31.1	382	76	216	437	4992

NOTE:
THE STATIC LOADS (RL1 , RL2) SHOWN IN THE TABLE ARE BASED ON A MAXIMUM SHEAVE SHAFT LOAD & MOTOR WEIGHT AS LISTED IN TABLE.



PLAN VIEW

CUSTOMER JOB DATA	
JOB NAME	AAVA
LIVE LOAD	6000 lbs.
ROPING	2:1
VEL.(FT/MIN)	500 fpm
% CWT.	45%
TRAVEL	100' - 5"
WRAP ANGLE	311°
COMPENSATION	N/A
SUSPENDED LOAD	24,320 bs.
CAR No.	S4

FRAME SIZE	RL_1	RL_2	SHEAVE SHAFT LOAD (MAX.)	M/C WEIGHT (LBS.)
570XL	(MAX LBS./FOOT)		50000 LBS	3850

CUSTOMER NAME MCE-Elevator Service, LLC CUSTOMER ORDER NO. _____ IMPERIAL ELEC. ORDER NO. MPEG20829

FRAME 570XL HP 58.8 RPM 187 VOLTS 382 AMPS 76 MOTOR MODEL 570EAG058KXXX

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X.XXX ±.005 [0.127]
X.XX ±.010 [0.254]
X.X ±.015 [0.381]
X° ±1°
UNLESS OTHERWISE NOTED.

REV.	ECN NO.	DATE	APPR.
A	REF. 5061	01-28-25	JRM

DRAWING SHEET 2 OF 2

THIRD ANGLE PROJECTION

IMPERIAL ELECTRIC The Driving Force in Motion — THE IMPERIAL ELECTRIC COMPANY Akron, Ohio 44306 — DRWG. SIZE D

DESCRIPTION: AC GEARLESS 570XL FRM, 1/2" CABLE 20.5" SHEAVE U GROOVES LT DWT

DRWN. BY: JRM DATE: 01-28-2025 SCALE: NONE CHK. BY: VM DRWG. # 3-2072-5075 REV. A

Nidec Elevator

Job Name	AAVA
Car No	S4
S/N	MPEG20829
Customer	MCE-Elevator Service, LLC

Car No.	Live Load Lbs.	Feet per Min.	CWT %	Roping	Sheave Diameter Inches	Rated Torque Ft-Lb.	Acceleration Torque Ft-Lb.	Total Torque Ft-Lb.	Motor Frame	Hp	Rpm	Rated HZ	Rated Motor Volts	Rated Amps	Peak Amps	Peak Drive Volts	Btu/HR Elevator Duty	Cable Size	Model	S/N
S4	6000	500	45	2:1	20.47	1655	3065	4720	570XL	58.8	187	31.1	382	76	216	437	4992	1/2"	570EAGXXXP754	MPEG20829

BASEMENT / SIDE-MOUNT APPLICATION FOR RATING IN BLUE

ALTERNATE EMERGENCY BRAKE REQUIRED FOR RATING IN GREEN

Imperial dual coil brake data	Car S4
	ZTW640-2X4100
All values are per coil.	CSC-15000D
Model	Frame 570XL
Pick Voltage Max.	230 VDC/COIL
Pick Voltage	200 VDC/COIL
Pick Current Amps	4 AMPS/COIL
Pick Duration	1 sec Max
Hold Voltage	100VDC/COIL
Hold Current Amps	2 AMPS/COIL
Cold Resistance	48Ω±6%/COIL
Hot Resistance	59Ω/COIL
Hold torque (ft-lbs) per shoe	3190
Cold resistance measured at 25°C (77°F).	

IE Engineering Data

01/27/2025

Verified and Accepted by:

Imperial Electric®

Nidec
All for dreams

FRAME 500 Series: 570-XL

Double Wrap

SPECIFICATIONS

- Capacity: 3,500 pounds (1:1) or 6,500 pounds (2:1)
- Speeds ranging from 100 to 800 fpm 1:1 roping
- Speeds ranging from 100 to 700 fpm 2:1 roping
- U-groove, 20-inch diameter sheave
- 12, 1/2" grooves for up to 6, 1/2" ropes, double wrap

FEATURES

- Precise acceleration, deceleration, and contract speed control
- Low noise, highly efficient
- Compact and Green - no oil lubricants
- Direct drive (no gears)
- Totally enclosed, self-cooling, no fan required
- Independent brake system holds 125% rated capacity
- Complete hardware package eliminates on-site engineering calculation and fabrication of heavy base and beam structures
- Sub-base with secondary sheave options
- Machine weight: 3,800 pounds
- Heidenhain ECN1313, 2048 ppr encoder provided
- UL/CSA CUS Certified

APPLICATIONS

- Modernization and new construction
- 1:1 and 2:1 roped installations, double wrap
- Sheave shaft load in 45,000 lbs
- Suspended load is 22,500 lbs - double wrap

Imperial Electric Frame 570-XL machines feature an extended chassis and a heavy duty outboard bearing support to easily accommodate the special load characteristics required for double-wrap roping configurations. With a maximum sheave shaft load of up to 45,000 pounds and dual-coil, independent brakes applying Ft-lbs brake torque per side, these machines offer 3,500 pound capacity roped 1:1 or 6,500 pound capacity roped 2:1 with maximum speeds of 800 and 700 fpm respectively.

iControl™

Motion Control Engineering (MCE)

TRACTION ELEVATOR CONTROLS

iControl AC | iControl DC

Integrated, intelligent, intuitive: the next generation in elevator control technology

MCE **iControl** is designed to be integrated into today's intelligent buildings environment. Standard Ethernet connectivity, an advanced graphical user interface, and optional supporting applications including real time monitoring, reporting, archiving, and building automation integration make iControl the stand-out choice for modern elevator systems.

Whether your installation uses AC, AC permanent magnet, or DC machines, iControl provides full support for quality drives including KEB TorqMax, MCE 12-Pulse SCR, Magnetek HPV 900 Series 2, Magnetek Quattro AC, and Magnetek Quattro DC. iControl supports ETA or Destination Based Dispatching systems. For most installations, no separate dispatcher is required. Any car in the group can be the designated dispatcher and, should it be taken off line, any other car in the group will seamlessly pick up the dispatching load. For large installations with heavy security, destination dispatching, or very sophisticated dispatching requirements, choose the stand-alone iCentral dispatcher.

iControl uses serial communications to reduce traveler wire counts and simplifies field connections through the available, iControl-specific, pre-labeled hoistway and traveler bundles. NEMA 1 and NEMA 4X hoistways are easily accommodated; the tapeless iLand for high-speed NEMA 1 hoistways or the robust LS-EDGE landing system for rugged hoistway conditions. The LS-EDGE is also used in low overhead clearance and slide guides applications.

Maximize return on investment and maintenance value. Select the system that provides a path forward through increasingly complex market requirements.

When the job deserves the best, think MCE iControl.

APPLICATIONS

- Modernization or new construction
- Low-rise through high-rise — up to 96 stops/192 openings, as little as one inch between floors
- Gearless or geared, DC, AC induction or AC permanent magnet
- Groups up to 12 cars
- 1600 fpm, 8.13 m/s (AC)
- 1800 fpm, 9.14 m/s (DC)

BENEFITS

- Intelligent — automated calibration, dispatching and traffic-handling allow iControl to learn and optimize for specific building requirements, increasing owner and tenant satisfaction.
- System self-configures for standard commissioning tests — you select the test, iControl sets up for it.
- Intuitive — Windows-based user interface is easy to learn and use, reducing installation time and maintenance cost.
- Safe — the most direct, advanced solution available, designed for ASME A17.1/CSA B44 and CSA B44.1/ASME A17.5 compliance, with robust engineering that anticipates updates.
- Cost-effective — streamlined, field-configurable hardware design. Fewer components to install, maintain or replace.
- Flexible — modular software and hardware layers accommodate changing system needs, gracefully and economically.
- Responsive — robust Ethernet interface facilitates secure remote monitoring, remote equipment control, remote diagnostics, even real time remote troubleshooting and adjustment.
- Create and configure complex car and group installations off site — then upload remotely or from the machine room. Create and re-use a "golden" file with minor adjustments from job to job.

Nidec
All for dreams

MCE
Motion Control Engineering®

www.nidec-mce.com
800.444.7442
916.463.9200

iControl™

Intelligent dispatching software

- Powerful, software-based dispatching engine uses artificial intelligence to continually optimize dispatching decisions.
- Easily modify, refine and scale configuration to meet changing traffic patterns.
- Modular upgrades ensure long-term performance, flexibility and return on investment.
- Real-time car status information delivered via high-speed, high bandwidth network for optimized response.

iControlware suite

- Windows-based interface enables on-site or remote analysis, diagnosis and parameter adjustment.
- Easily set up and adjust controller configuration.
- Conveniently and flexibly manage multiple elevators and locations from a single PC.
- Client-server system gathers, archives and reports elevator performance data for on-site or remote access.
- Flexible programming options for on-demand or scheduled reporting of performance criteria.
- Automated, fully-configurable maintenance requests initiated from the controller.

Precision landing systems

- Innovative systems use sensors and magnetic encoding to ensure absolute hoistway position.
- iLand tapeless or LS-EDGE perforated steel tape systems available.
- Systems maintain car position across power failure.

Cartop wiring connection box

- Reduced traveling cable wire count for labor and material savings. Plug-and-play installation reduces setup time.
- Traveler and hoistway cable tailored for iControl. All conductors clearly labeled and color-coded. Eliminate connection errors and save installation time.

iControl Specifications

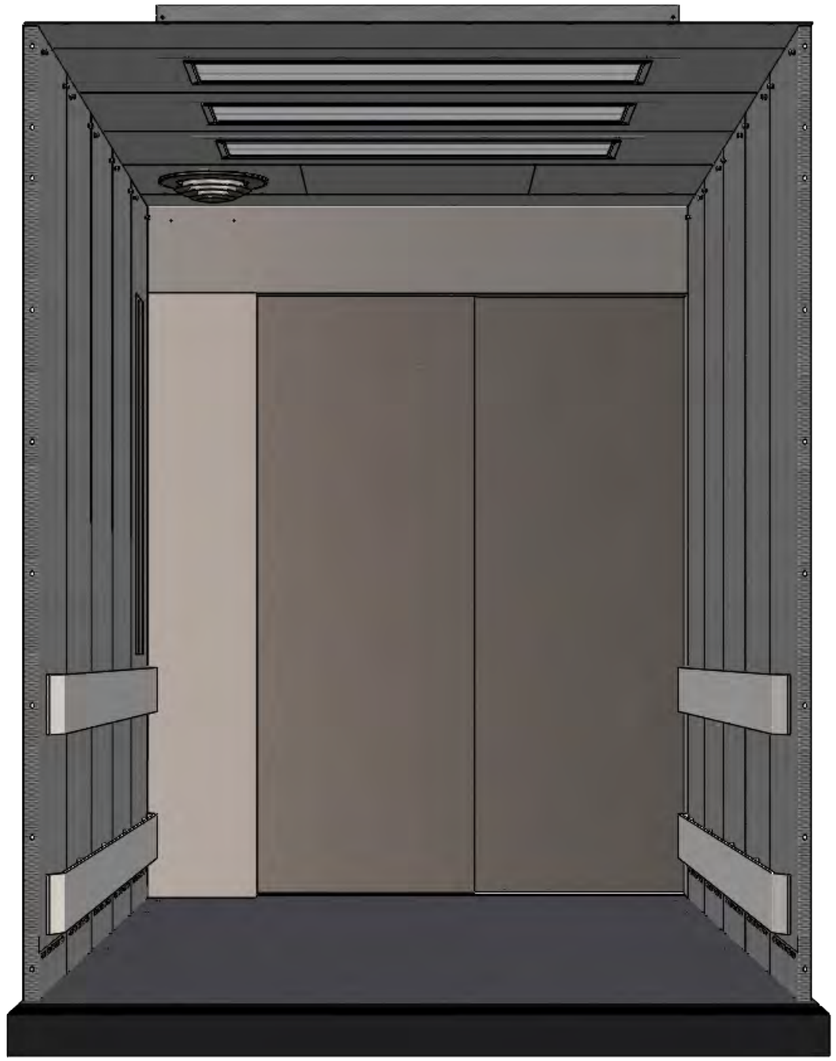
	iControl AC	iControl DC
Maximum Car Speed	1600 fpm, 8.13m/s	1800 fpm, 9.14m/s
Configuration	Simplex and group	Simplex and group
Landings	96	96
Drive type	KEB TorqMax, Magnetek 900 HPV Series 2, or Magnetek Quattro AC	MCE 12-Pulse SCR or Magnetek Quattro DC
Motor Control	Velocity feedback	Velocity feedback
Landing System	iLand - Sensors and magnetic encoding ensure absolute hoistway position. Tapeless, low-maintenance system. LS-EDGE - Robust, high accuracy, perforated steel tape/ hall-effect sensor system for low overhead or NEMA 4X applications. Power fail position retention and simple RJ-45 connectivity. The LS-EDGE is also used in low overhead clearance and slide guides applications.	
Configuration, monitoring and reporting	iControlware suite for configuration, monitoring, reporting, archival and BMS integration. Includes iView, iMonitor, iReport, BMS-LINK, SENTRY Security, and specialty jail transport applications.	
Dispatching	PC-based or embedded microcontroller software intuitively assigns calls and continuously monitors efficiency. ETA dispatching standard; Destination Based Dispatching available with iCentral.	
Environment	32-104˚F, 0-40˚C, humidity non-condensing up to 95%; harsh environment rugged service options available	
Standard enclosure	42” w x 72” h x 16” d, 914.4 x 1,447.8 x 304.8 mm Enclosure size may vary per specific application	

Nidec All for dreams

MCE Motion Control Engineering®

www.nidec-mce.com
800.444.7442
916.463.9200

COVER PAGE



PERSPECTIVE VIEW

PROJECT SCOPE OF WORK (FULL CAB-QTY:1)

CAR(S):S4

JOB COMPONENT	DESCRIPTION
FRONT DOORS	60" X 84" 1SPD SS-RH, 1¼" CORE. CLAD WITH #4 SATIN STAINLESS STEEL [16 GA]
REAR DOORS	60" X 84" 1SPD SS-LH, 1¼" CORE. CLAD WITH #4 SATIN STAINLESS STEEL [16 GA]
FRONTS	(2) STRIKES, (2) RETURNS, AND (2) FULL WIDTH TRANSOMS, #4 SATIN STAINLESS STEEL [16 GA]
SHELL WALLS	5WL RIGIDIZED STAINLESS STEEL [14 GA] WITH SOUND DEADENING
UPPER CEILING	PRIMED WHITE HRPO STEEL [12 GA] WITH HINGED EXIT AND SWITCH
LIGHTING	(3) 48" RECESSED LIGHT BOXES WITH (4) T8 LED LAMPS EACH, COLOR TEMP: 4000K
HANDRAILS AND BUMPER RAILS	⅜" X 6" STAINLESS STEEL FLAT BAR WITH FORMED ENDS AT SIDE WALLS
HANDRAIL BRACKETS	1"Ø X 1½" LONG STAINLESS STEEL, REMOVABLE WITH 2" X 2" PLATES
SILLS	(2) 5½" NICKEL SILVER (LENGTH: 92⅝")
FAN	MAN-D-TEC MVS-OE WITH WHITE GRILL
PADS HANGERS	STAINLESS STEEL STUDS AT SIDE WALLS AND RETURNS
OPERATOR SUPPORTS AND HEADER ANGLES	BY G&R

NOTE: ALL GRAIN DIRECTION RUNS THE LONG DIRECTION OF THE PART, UNLESS OTHERWISE NOTED

TOTAL WEIGHT: 2,304 LBS

JOB NAME: ANN ARBOR VA

CAR(S) # S4 **CAPACITY:** 6000 LBS

LOCATION: ANN ARBOR, MI

CUSTOMER: ELEVATOR SERVICE, INC.

SIZE **B**

CUSTOMER#: PO-0002084

DRAWN BY: ADP - 01/07/25

SHEET 1 OF 6

JOB NO.: 23806

G&R Custom Elevator Cabs
2352 STATION PARKWAY NW
ANDOVER, MN 55304
PHONE: 763-757-6177
FAX: 763-757-6420

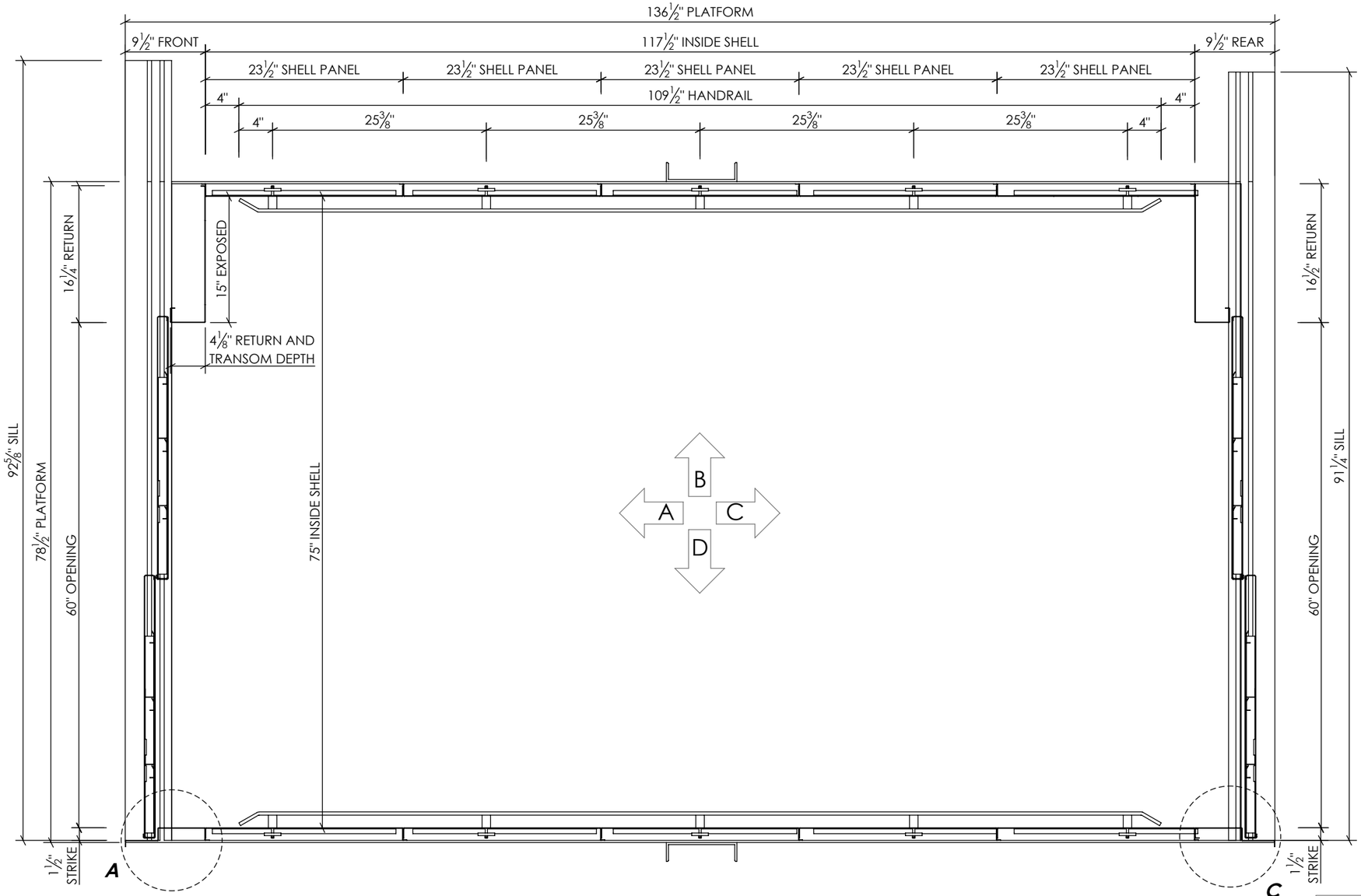
PRINT RECORD

DATE	STATUS
01/13/25	APPROVAL

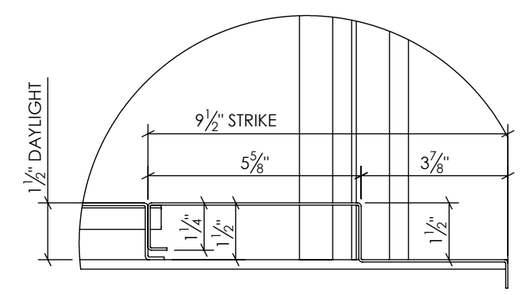
PROPRIETARY AND CONFIDENTIAL

THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF G &R CUSTOM ELEVATOR CABS. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF G &R CUSTOM ELEVATOR CABS IS PROHIBITED.

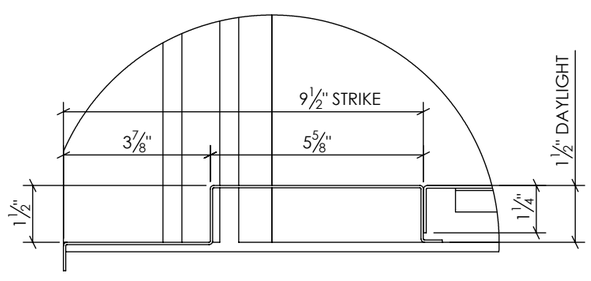
PLAN VIEW



PLAN VIEW



REAR DETAIL



FRONT DETAIL

JOB NAME: ANN ARBOR VA	
CAR(S) # S4	**CAPACITY:** 6000 LBS
LOCATION: ANN ARBOR, MI	
CUSTOMER: ELEVATOR SERVICE, INC.	
SIZE **B**	**CUSTOMER#:** PO-0002084
	DRAWN BY: ADP - 01/07/25
	SHEET 2 OF 6
	JOB NO.: 23806

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ANDOVER, MN 55304
PHONE: 763-757-6177
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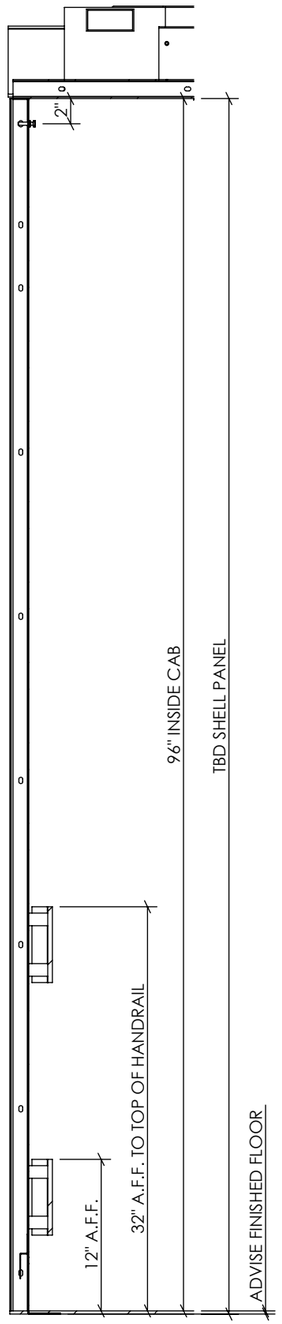
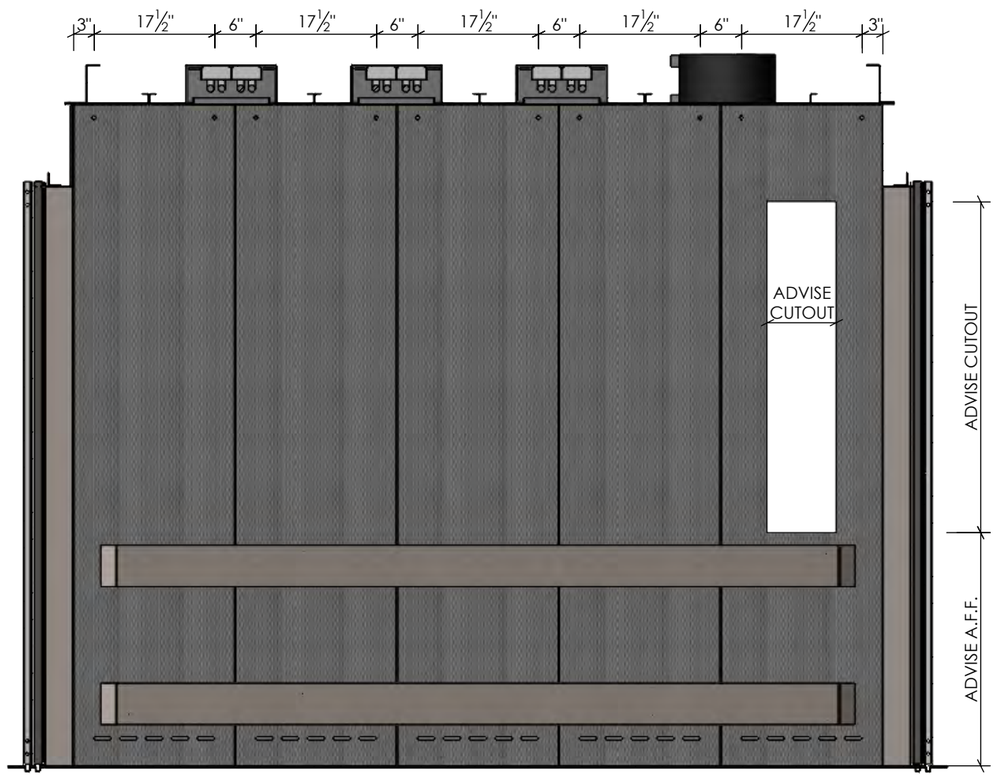
ELEVATION VIEWS



SECTION VIEW
(SIDE WALLS)

PAD HANGER LOCATIONS



ELEVATION VIEW
(SIDE WALLS)

REQUIRED VENTILATION:
THE TOTAL NATURAL VENTILATION MUST BE EQUAL TO 3.5% OF THE FLOOR AREA, EQUALLY DISTRIBUTED BETWEEN THE TOP AND BOTTOM OF THE CAB LESS "DEDUCT" AREA FOR EXISTING DOOR GAPS/OPENINGS. FROM THE OVERALL PROJECT INFORMATION PROVIDED, THE VENTILATION REQUIRED IS:

BOTTOM OF CAB: 85 SQ. INCHES

PROPRIETARY AND CONFIDENTIAL

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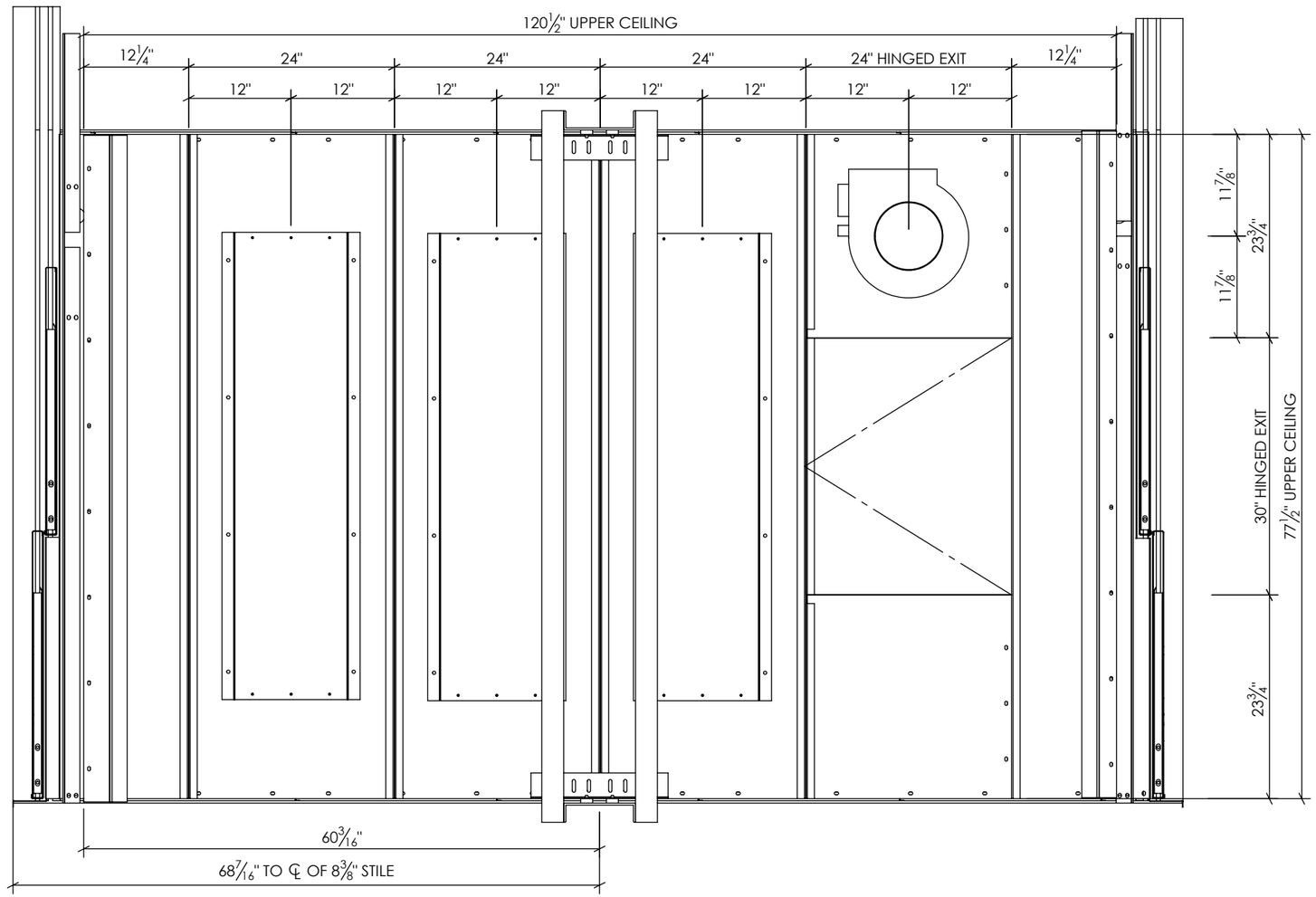
JOB NAME: ANN ARBOR VA	
CAR(S) # S4	**CAPACITY:** 6000 LBS
LOCATION: ANN ARBOR, MI	
CUSTOMER: ELEVATOR SERVICE, INC.	
SIZE **B**	**CUSTOMER#:** PO-0002084
	DRAWN BY: ADP - 01/07/25
	SHEET 3 OF 6
	JOB NO.: 23806

G&R Custom Elevator Cabs
2352 STATION PARKWAY NW
ANDOVER, MN 55304
PHONE: 763-757-6177
FAX: 763-757-6420

CEILING VIEWS



UPPER CEILING PLAN

JOB NAME: ANN ARBOR VA	
CAR(S) # S4	**CAPACITY:** 6000 LBS
LOCATION: ANN ARBOR, MI	
CUSTOMER: ELEVATOR SERVICE, INC.	
SIZE **B**	**CUSTOMER#:** PO-0002084
	DRAWN BY: ADP - 01/07/25
	SHEET 4 OF 6
	JOB NO.: 23806

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ANDOVER, MN 55304
PHONE: 763-757-6177
FAX: 763-757-6420

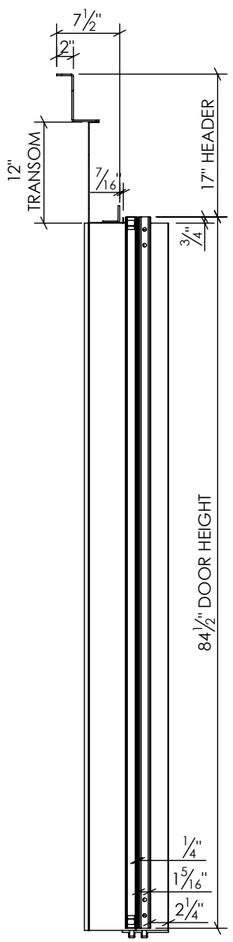
FRONT DETAILS

FRONT OPENING	1SPD SS-RH
DOOR OPERATOR	GAL (REFERENCE GAL DRAWING 8231)
FRONT MATERIAL	#4 SATIN STAINLESS STEEL [14GA]

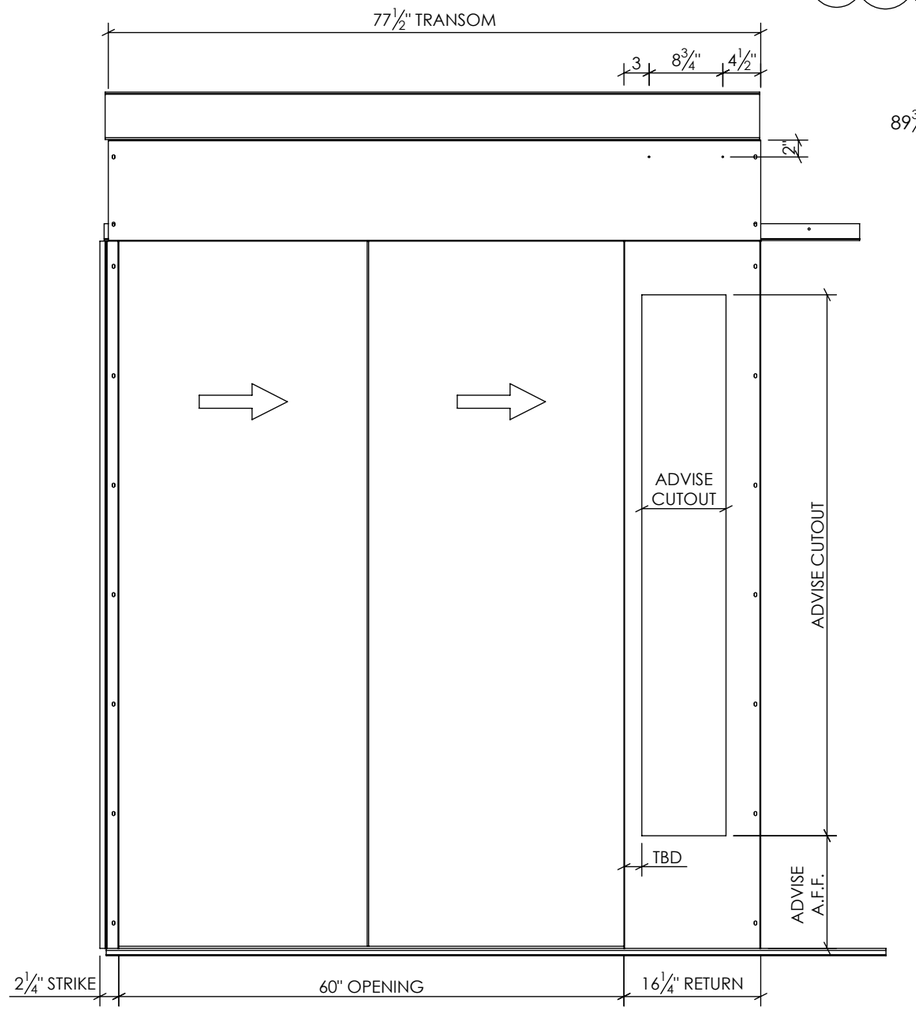
NOTE: ALL DRILLING TO MATCH DOOR OPERATOR

NOTE: HEADER ANGLE/OPERATOR SUPPORT PROVIDED BY G&R

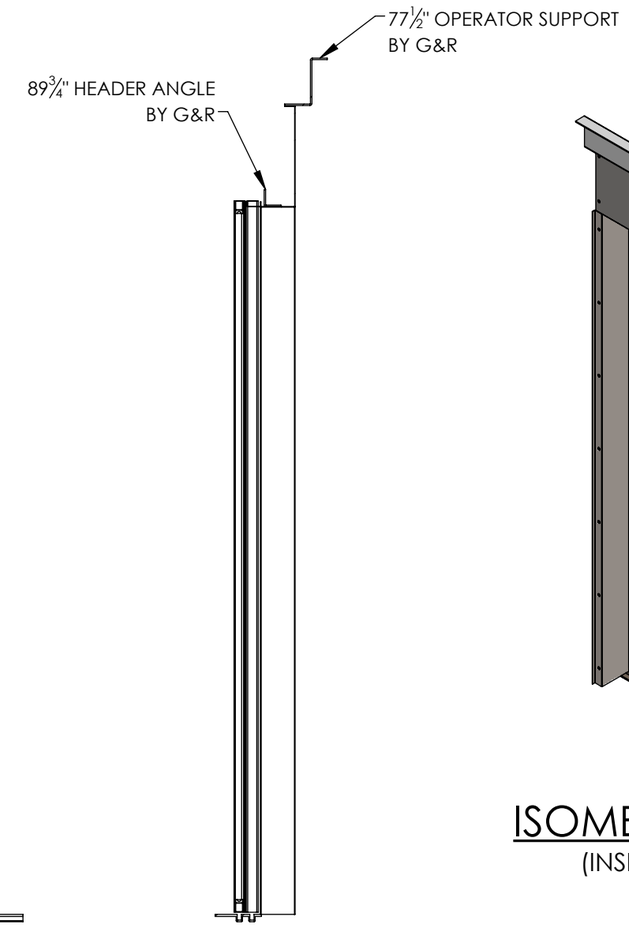
ELEVATOR SERVICE TO ADVISE FIXTURE DRAWINGS AND LOCATION OF CDL CUTOUT



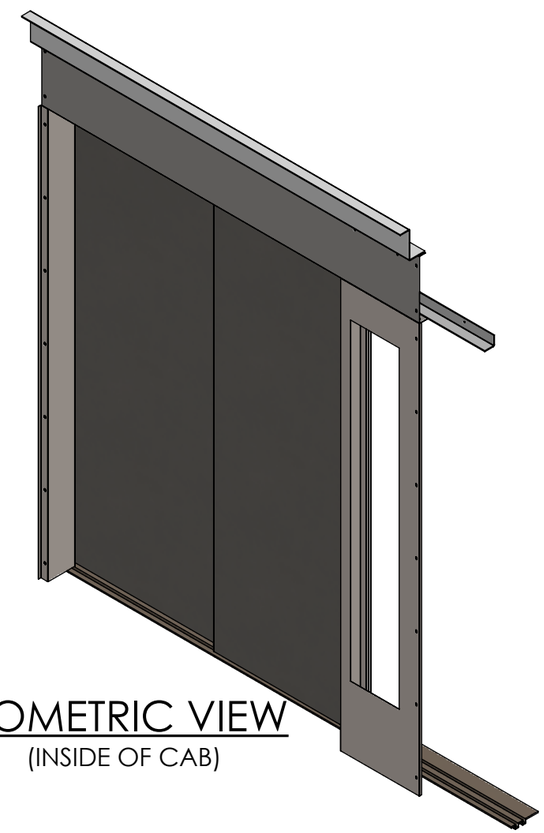
SECTION VIEW
(STRIKE)



ELEVATION VIEW
(FRONT)



SECTION VIEW
(RETURN)



ISOMETRIC VIEW
(INSIDE OF CAB)

DOOR PANEL INFORMATION	
DOOR PANEL WIDTH	31 1/8"
DOOR CORE THICKNESS	1 1/4"
DOOR STRUCTURE	PRIMED CRS [16 GA]
DOOR CLAD	#4 SATIN STAINLESS STEEL [20 GA]
DOOR SOUND DEADEN	NO
DOOR GIBS	NYLUBE DL-2 (2 PER PANEL)

JOB NAME: ESSENTIA HEALTH ST. MARYS

CAR(S) # C **CAPACITY:** 4500 LBS LBS.

LOCATION: DETROIT LAKES, MN

CUSTOMER: TK ELEVATOR

SIZE **B**

CUSTOMER#: --

DRAWN BY: ADP - 01/06/25

SHEET 5 OF 6

JOB NO.: 23801

PROPRIETARY AND CONFIDENTIAL

THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF G &R CUSTOM ELEVATOR CABS. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF G &R CUSTOM ELEVATOR CABS IS PROHIBITED.

G&R Custom Elevator Cabs
2352 STATION PARKWAY NW
ANDOVER, MN 55304
PHONE: 763-757-6177
FAX: 763-757-6420

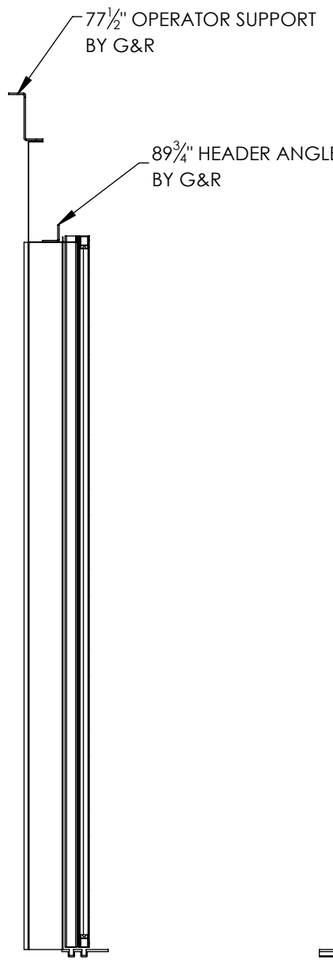
FRONT DETAILS

FRONT OPENING	1SPD SS-LH
DOOR OPERATOR	GAL (REFERENCE GAL DRAWING 8231)
FRONT MATERIAL	#4 SATIN STAINLESS STEEL [14 GA]

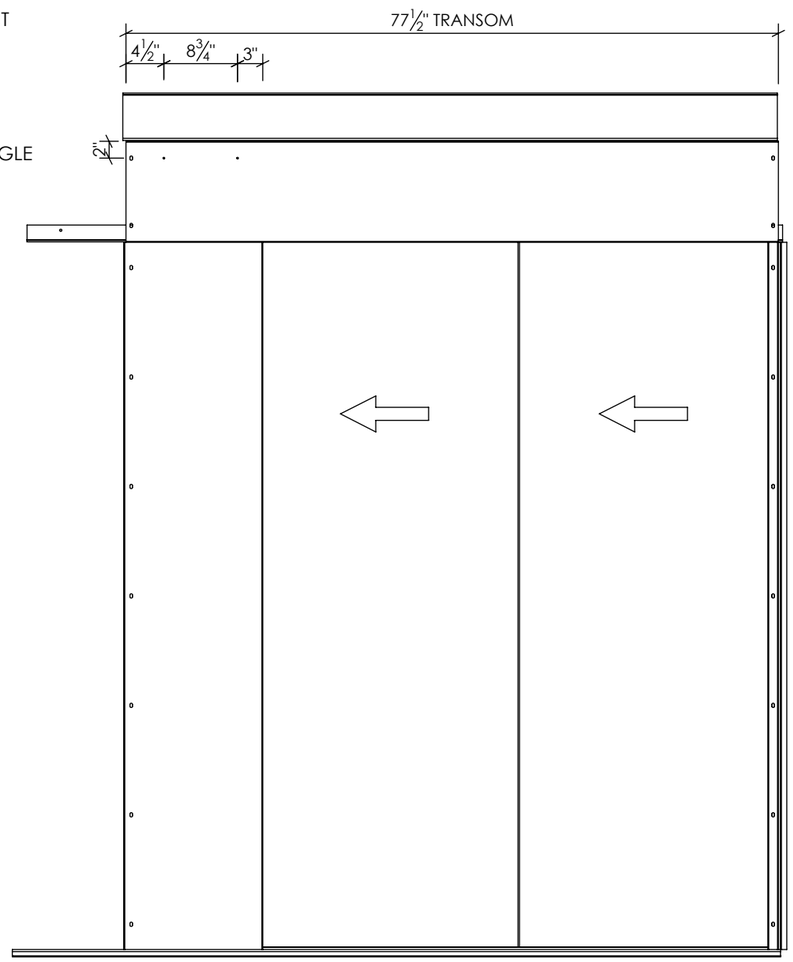
NOTE: ALL DRILLING TO MATCH DOOR OPERATOR

NOTE: HEADER ANGLE/OPERATOR SUPPORT PROVIDED BY G&R

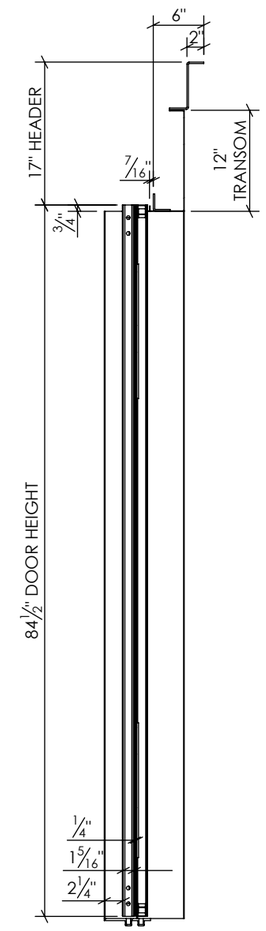
ELEVATOR SERVICE TO ADVISE FIXTURE DRAWINGS AND LOCATION OF CDL CUTOUT



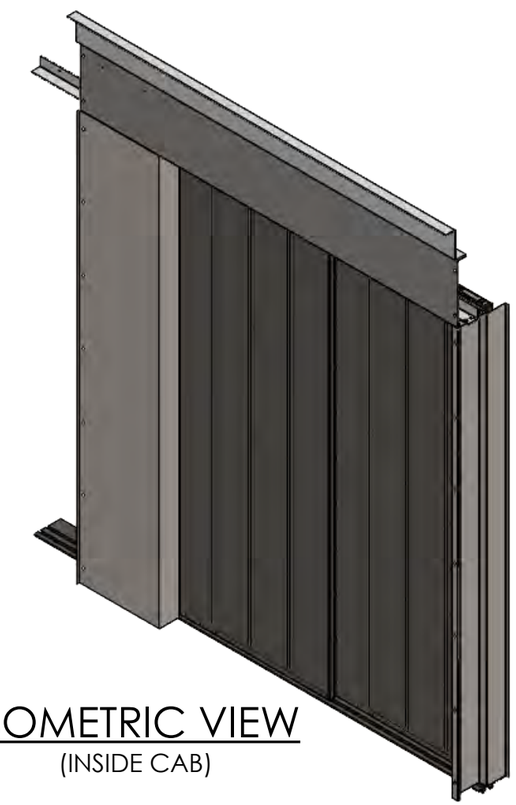
SECTION VIEW
(RETURN)



ELEVATION VIEW
(FRONTS)



SECTION VIEW
(STRIKE)



ISOMETRIC VIEW
(INSIDE CAB)

DOOR PANEL INFORMATION	
DOOR PANEL WIDTH	31⅛"
DOOR CORE THICKNESS	1¼"
DOOR STRUCTURE	PRIMED WHITE CRS [16 GA]
DOOR CLAD	#4 SATIN STAINLESS STEEL [20 GA]
DOOR SOUND DEADEN	NO
DOOR GIBS	NYLUBE DL-2 (2 PER PANEL)

JOB NAME: ANN ARBOR VA

CAR(S) # S4 **CAPACITY:** 6000 LBS.

LOCATION: ANN ARBOR, MI

CUSTOMER: ELEVATOR SERVICE, INC.

SIZE **B**

PROPRIETARY AND CONFIDENTIAL

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G&R Custom Elevator Cabs
2352 STATION PARKWAY NW
ANDOVER, MN 55304
PHONE: 763-757-6177
FAX: 763-757-6420

CUSTOMER#: PO-0002084

DRAWN BY: ADP - 01/07/25

SHEET 6 OF 6

JOB NO.: 23806

REVISION RECORD

DATE	REV		REV BY
01/09/25	A	PRELIMINARY DRAWING – REFERENCE# 622377	TCM
01/22/25	B	REVISED PRELIMINARY	TCM
		SHEET 2 OF 7: CHANGED FIRE YEAR CODE TO 2019	
		ADDED WURCOM 2019 DEVICES	
		SHEET 6 OF 7: ADDED WURCOM 2019 ACCESSORIES	

DATE	REV		REV BY

DATE	REV		REV BY

PURCHASE ORDER NO.

0002186

INNOVATION JOB NO.

CUSTOMER JOB NO.

QUOTE NO.

010325SD9

INNOVATION INDUSTRIES INC
3500 E. MAIN ST., RUSSELLVILLE, AR 72802
(479) 968-2232 FAX (479) 968-7986

COMPANY / JOB NAME
ELEVATOR SERVICES INC. / ANN ARBOR VA S4

LOCATION:
ANN ARBOR, MI

SALES REP:
SD

FILE NAME
010325SD9A

CHECKED:

SHEET NO.
1 OF 7

REV B-REVISED PRELIMINARY

DRAWN BY:
TCM

DO NOT SCALE

SIZE B

LANDING	FLOOR MARKINGS FRONT	REAR	SIDE
60			
59			
58			
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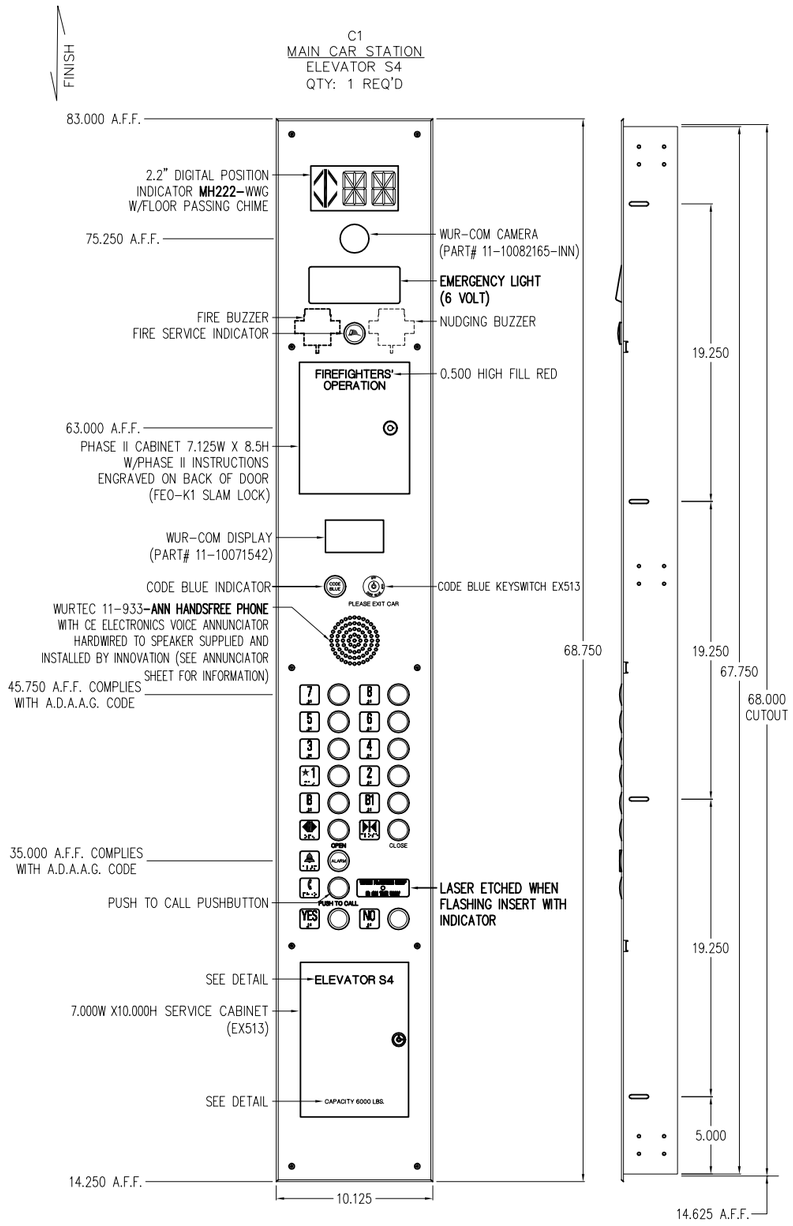
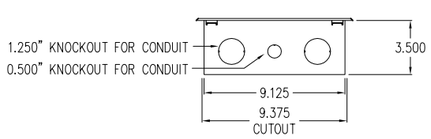
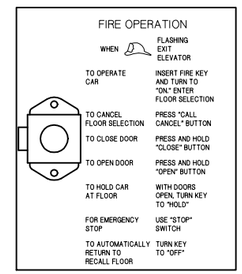
10	8		
9	7		
8	6		
7	5		
6	4		
5	3		
4	2		
3	*1		
2	B1		
1		B	



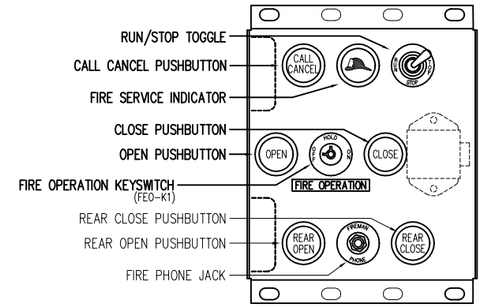


PANEL KEYSWITCH AND TOGGLE LEGEND						
SWITCH IDENTIFICATION	OPERATING POSITIONS	KEY REMOVE POSITION	MAINTAINED POSITIONS	MOMEN. POS.	MOUNT	HALO COLOR
STOP	RUN-STOP	ALL	ALL		HOR	RED
CODE BLUE	OFF-ON	OFF	ALL		SWH	BLUE

REAR VIEW OF FIRE DOOR (2005-2022)

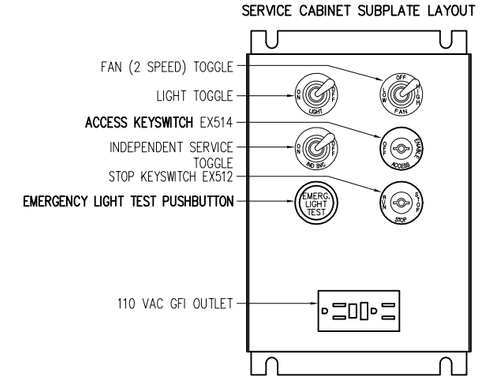


2008-2022 ASME FIRE CABINET SUBPLATE LAYOUT



FIRE SERVICE CABINET KEYSWITCH & TOGGLE LEGEND						
SWITCH IDENTIFICATION	OPERATING POSITIONS	KEY REMOVE POSITION	MAINTAINED POSITIONS	MOMEN. POS.	MOUNT	HALO COLOR
FIRE OPERATION	OFF-HOLD-ON	OFF-HOLD	ALL		VER	RED
STOP	RUN-STOP		ALL		VER	RED

SERVICE CABINET SUBPLATE LAYOUT



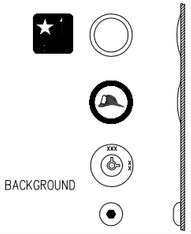
SERVICE CABINET KEYSWITCH AND TOGGLE LEGEND						
SWITCH IDENTIFICATION	OPERATING POSITIONS	KEY REMOVE POSITION	MAINTAINED POSITIONS	MOMEN. POS.	MOUNT	HALO COLOR
LIGHT	ON-OFF		ALL		HOR	BLACK
FAN (2 SPEED)	LOW-OFF-HIGH		ALL		HOR	BLACK
IND SVC	ON-OFF		ALL		HOR	BLACK
ACCESS	OFF-ENABLE	ALL	ALL		HOR	BLACK

DEVICE STYLE

PB-45 PUSHBUTTON WHITE LED
PB-2 INDICATOR
PB-2 KEYSWITCH
PB-1 TOGGLE

BRAILLE ADA COMPLIANT:

● 1.250 [31.75 mm] SQ.
_____ CUSTOM FISHTAIL BRAILLE
_____ OVAL SURROUND 2.750 X 1.500
_____ 1.375 [34.93 mm] DIA.
STAINLESS CHARACTERS ON BLACK BACKGROUND
FASTENERS (#10-24 X 1.000) BUTTONHEAD



ADVISORY NOTES

1. **CUSTOMER TO SUPPLY WIRING DIAGRAMS PRIOR TO MANUFACTURING.**

ELEVATOR CONTROLLER INFORMATION

MANUFACTURER: MCE
MODEL:
FIXTURE VOLTAGE: 24 VDC

EXISTING RETURN DIMENSIONS

HEIGHT:
WIDTH:
JAMB DEPTH:

EXISTING FACEPLATE DIMENSIONS

HEIGHT: 61.625
WIDTH: 10.125
TOP AFF: 78.000
BOTTOM AFF: 16.375

CAR STATION INFORMATION

MATERIAL: 11 GA. (TYPE 304) STAINLESS STEEL
FINISH: NO. 4 BRUSHED
ENGRAVING FONT: HELVETICA LIGHT
BEVEL 15°: YES
PREWIRE: YES
HINGING: LEFT
HINGE TYPE (QTY): SLIDE (3 REQ'D)
CAPACITY: CAPACITY 6000 LBS.

ASME / STATE / FIRE CODE

FIRE YEAR CODE: 2019
FIRE KEYCODE: FEO-K1

DIGITAL PI INFORMATION

DISPLAY COLOR: WHITE
LENS COLOR: GRAY
SIGNAL VOLTAGE:
SIGNAL FORMAT:
NO. OF INPUTS:
SCROLLING: (IH320 ONLY)

INNOVATION INDUSTRIES INC
3500 E. MAIN ST., RUSSELLVILLE, AR 72802
(479) 968-2232 FAX (479) 968-7986

ENGRAVING DETAILS

0.500 HIGH FILL BLACK → ELEVATOR S4
0.250 HIGH FILL BLACK → CAPACITY 6000 LBS.

APPROVED AS DRAWN:
APPROVED AS NOTED:
REVISE AND RESUBMIT:
APPROVED BY:
DATE:

COMPANY / JOB NAME: ELEVATOR SERVICES INC. / ANN ARBOR VA S4
LOCATION: ANN ARBOR, MI
PURCHASE ORDER NO.: 0002186

JOB NO.	WORK ORDER NO.	QUOTE NO.
		010325SD9
SALES REP: SD	FILE NAME 010325SD9B	SHEET NO. 2 OF 7

REV B-REVISED PRELIMINARY
DRAWN BY: TCM

DO NOT SCALE
SIZE B

LANDING	FLOOR MARKINGS FRONT	REAR	SIDE
60			
59			
58			
57			
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53			
52			
51			
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49			
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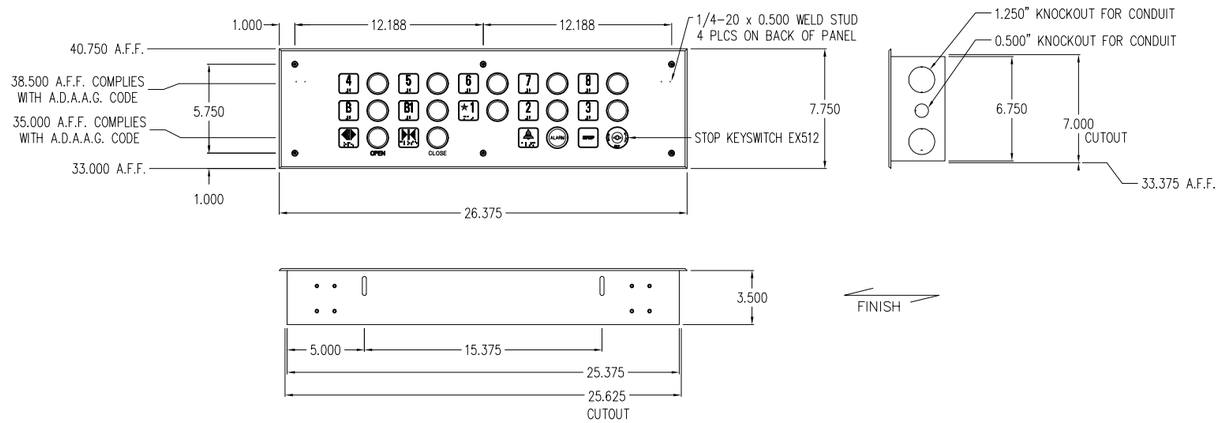
7	5		
6	4		
5	3		
4	2		
3	*1		
2	B1		
1		B	

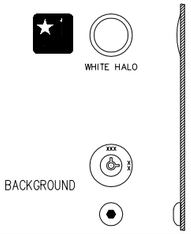
C2
AUXILIARY CAR STATION
ELEVATOR S4
QTY: 1 REQ'D



PANEL KEYSWITCH AND TOGGLE LEGEND						
SWITCH IDENTIFICATION	OPERATING POSITIONS	KEY REMOVE POSITION	MAINTAINED POSITIONS	MOMEN. POS.	MOUNT	HALO COLOR
STOP	RUN-STOP	ALL	ALL		HOR	RED

DEVICE STYLE

PB-45 PUSHBUTTON WHITE LED
_____ INDICATOR
PB-2 KEYSWITCH
_____ TOGGLE



BRAILLE ADA COMPLIANT:

● 1.250 [31.75 mm] SQ.
_____ CUSTOM FISHTAIL BRAILLE
_____ OVAL SURROUND 2.750 X 1.500
_____ 1.375 [34.93 mm] DIA.
STAINLESS CHARACTERS ON BLACK BACKGROUND
FASTENERS (#10-24 X 1.000) BUTTONHEAD

ADVISORY NOTES

1. **CUSTOMER TO SUPPLY WIRING DIAGRAMS PRIOR TO MANUFACTURING.**

GENERAL NOTES

1. PANEL TO HINGE DOWN WITH CABLE SUPPORTS.

ELEVATOR CONTROLLER INFORMATION

MANUFACTURER: MCE
MODEL:
FIXTURE VOLTAGE: 24 VDC

EXISTING RETURN DIMENSIONS

HEIGHT:
WIDTH:
JAMB DEPTH:

EXISTING FACEPLATE DIMENSIONS

HEIGHT:
WIDTH:
TOP AFF: 40.750
BOTTOM AFF: 33.000

CAR STATION INFORMATION

MATERIAL: 11 GA. (TYPE 304) STAINLESS STEEL
FINISH: NO. 4 BRUSHED
ENGRAVING FONT:
BEVEL 15°: YES
PREWIRE: YES
HINGING: DOWN
HINGE TYPE (QTY): SLIDE (2 REQ'D)
CAPACITY:

ASME / STATE / FIRE CODE

FIRE YEAR CODE: 2019
FIRE KEYCODE:

DIGITAL PI INFORMATION

DISPLAY COLOR:
LENS COLOR:
SIGNAL VOLTAGE:
SIGNAL FORMAT:
NO. OF INPUTS:
SCROLLING: (IH320 ONLY)

INNOVATION INDUSTRIES INC
3500 E. MAIN ST., RUSSELLVILLE, AR 72802
(479) 968-2232 FAX (479) 968-7986

COMPANY / JOB NAME
ELEVATOR SERVICES INC. / ANN ARBOR VA S4

LOCATION:
ANN ARBOR, MI

PURCHASE ORDER NO.
0002186

JOB NO.	WORK ORDER NO.	QUOTE NO.
		010325SD9
SALES REP: SD	FILE NAME 010325SD9C	SHEET NO. 3 OF 7
REV B-REVISED PRELIMINARY		DRAWN BY: TCM
DO NOT SCALE		SIZE B

APPROVED AS DRAWN:	APPROVED BY:
APPROVED AS NOTED:	
REVISE AND RESUBMIT:	DATE:

LANDING	ELEVATOR S4 FLOOR MARKINGS FRONT	REAR	SIDE
60			
59			
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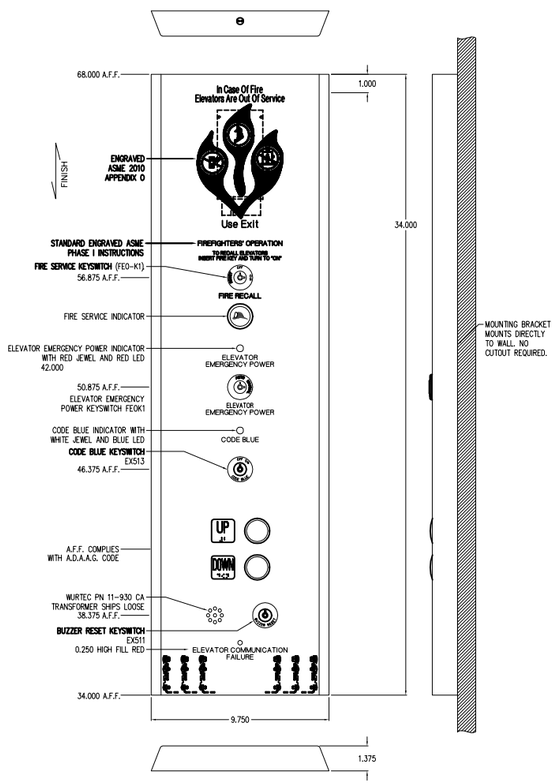
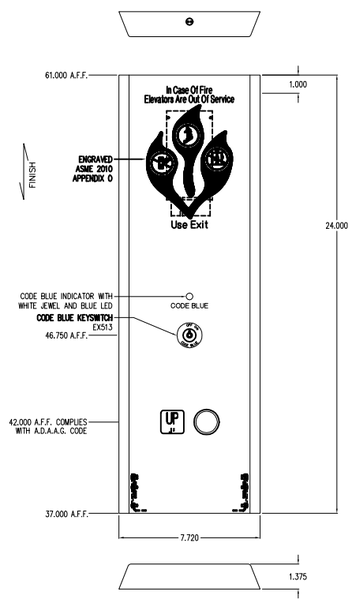
2	B1		
1		B	

H3
"PH" SERIES HINGED SURFACE MOUNT INTERMEDIATE HALL STATION
QTY: 1 REQ'D
REQ'D @ FLOOR *1



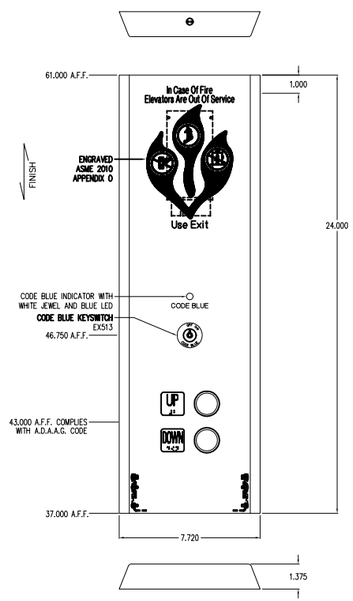
KEYSWITCHES ON FACEPLATE						
SWITCH IDENTIFICATION	OPERATING POSITIONS	KEY REMOVE POSITION	MAINTAINED POSITIONS	MOMEN. POS.	MOUNT	HALO COLOR
FIRE RECALL	RESET-OFF-ON	OFF-ON	ALL		HOR	RED
BUZZER RESET	**(OFF-ON)**	**(OFF)**	**(OFF)**	**(ON)**	**HOR**	**BLACK**
CODE BLUE	OFF-ON	OFF	OFF	ON	HOR	BLUE
ELEV EMERG PWR	AUTO-MANUAL	ALL	ALL		HOR	RED

H1
"PH" SERIES HINGED SURFACE MOUNT TERMINAL HALL STATION
QTY: 1 REQ'D
REQ'D @ FLOOR B



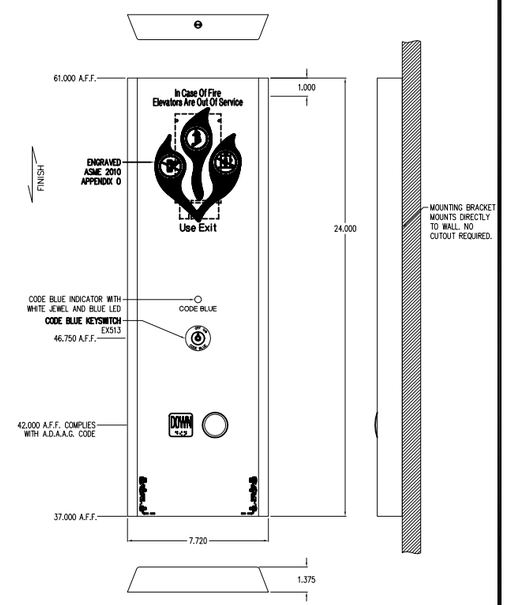
KEYSWITCHES ON FACEPLATE						
SWITCH IDENTIFICATION	OPERATING POSITIONS	KEY REMOVE POSITION	MAINTAINED POSITIONS	MOMEN. POS.	MOUNT	HALO COLOR
CODE BLUE	OFF-ON	OFF	OFF	ON	HOR	BLUE

H4
"PH" SERIES HINGED SURFACE MOUNT INTERMEDIATE HALL STATION
QTY: 7 REQ'D
REQ'D @ FLOOR B1,2,3,4,5,6,7



KEYSWITCHES ON FACEPLATE						
SWITCH IDENTIFICATION	OPERATING POSITIONS	KEY REMOVE POSITION	MAINTAINED POSITIONS	MOMEN. POS.	MOUNT	HALO COLOR
CODE BLUE	OFF-ON	OFF	OFF	ON	HOR	BLUE

H2
"PH" SERIES HINGED SURFACE MOUNT TERMINAL HALL STATION
QTY: 1 REQ'D
REQ'D @ FLOOR 8



KEYSWITCHES ON FACEPLATE						
SWITCH IDENTIFICATION	OPERATING POSITIONS	KEY REMOVE POSITION	MAINTAINED POSITIONS	MOMEN. POS.	MOUNT	HALO COLOR
CODE BLUE	OFF-ON	OFF	OFF	ON	HOR	BLUE

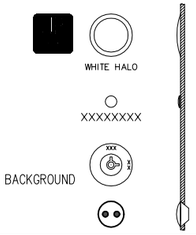
DEVICE STYLE

PB-45 PUSHBUTTON WHITE LED
PB-13 INDICATOR
PB-2 KEYSWITCH
_____ TOGGLE

BRAILLE ADA COMPLIANT:

● 1.250 [31.75 mm] SQ.
_____ CUSTOM FISHTAIL BRAILLE
_____ OVAL SURROUND 2.750 X 1.500
_____ 1.375 [34.93 mm] DIA.
STAINLESS CHARACTERS ON BLACK BACKGROUND

FASTENERS (#10-24 X 1.000) SPANNERHEAD



ELEVATOR CONTROLLER INFORMATION

MANUFACTURER: MCE
MODEL:
FIXTURE VOLTAGE: 24 VDC
POLARITY

EXISTING FACEPLATE DIMENSIONS

HEIGHT: H1,2,4/9.750, H3/14.000
WIDTH: H1,2,4/3.500, H3/3.250
TOP AFF: H1,2,4/46.750, H3/50.500
BOTTOM AFF: H1,2,4/37.000, H3/36.500
BOX DEPTH:

LANTERN INFORMATION

UP:
DOWN:
HALL CHIME:
CAR CHIME:

HALL EQUIPMENT INFORMATION

MATERIAL: 16 GA. (TYPE 304) STAINLESS STEEL
FINISH: NO. 4 BRUSHED
ENGRAVING FONT: HELVETICA LIGHT
BEVEL 15°: NO
PREWIRE: YES

ASME / STATE / FIRE CODE

FIRE YEAR CODE: 2019
FIRE KEYCODE: FEO-K1

DIGITAL PI INFORMATION

DISPLAY COLOR:
LENS COLOR:
SIGNAL VOLTAGE:
SIGNAL FORMAT:
NO. OF INPUTS:
SCROLLING: (IH320 ONLY)

INNOVATION INDUSTRIES INC
3500 E. MAIN ST., RUSSELLVILLE, AR 72802
(479) 968-2232 FAX (479) 968-7986

COMPANY / JOB NAME
ELEVATOR SERVICES INC. / ANN ARBOR VA S4

LOCATION:
ANN ARBOR, MI

PURCHASE ORDER NO.
0002186

JOB NO.	WORK ORDER NO.	QUOTE NO. 010325SD9
SALES REP: SD	FILE NAME 010325SD9D	SHEET NO. 4 OF 7
REV B-REVISED PRELIMINARY		DRAWN BY: TCM
DO NOT SCALE		SIZE B

APPROVED AS DRAWN:	APPROVED BY:
APPROVED AS NOTED:	
REVISE AND RESUBMIT:	DATE:

LANDING	ELEVATOR S4 FLOOR MARKINGS FRONT	REAR	SIDE
60			
59			
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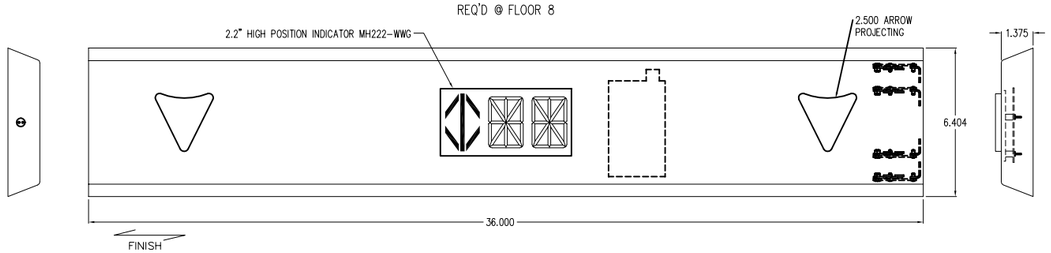
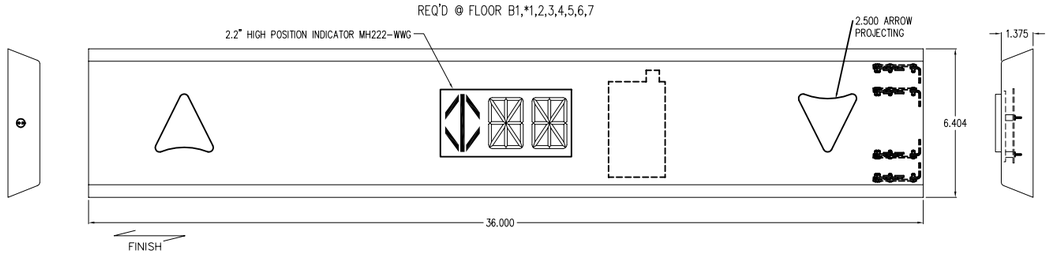
6	5		
5	4		
4	3		
3	2		
2	*1		
1	B		

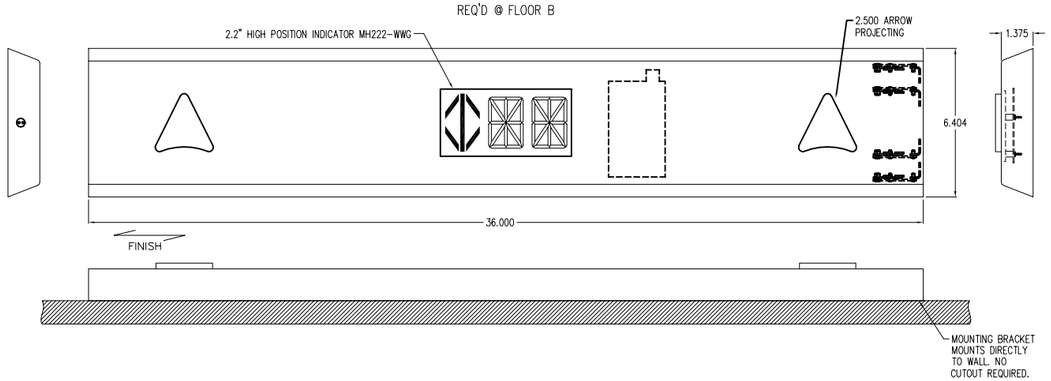
HPI-2
"PH" SERIES HINGED SURFACE MOUNT DIGITAL HALL PI W/ LANTERNS
QTY: 1 REQ'D
REQ'D @ FLOOR 8



HPI-3
"PH" SERIES HINGED SURFACE MOUNT DIGITAL HALL PI W/ LANTERNS
QTY: 8 REQ'D
REQ'D @ FLOOR B1,*1,2,3,4,5,6,7



HPI-1
"PH" SERIES HINGED SURFACE MOUNT DIGITAL HALL PI W/ LANTERNS
QTY: 1 REQ'D
REQ'D @ FLOOR B



DEVICE STYLE

_____ PUSHBUTTON _____
_____ INDICATOR
_____ KEYSWITCH
_____ TOGGLE

BRAILLE ADA COMPLIANT:

_____ 1.250 [31.75 mm] SQ.
_____ CUSTOM FISHTAIL BRAILLE
_____ OVAL SURROUND 2.750 X 1.500
_____ 1.375 [34.93 mm] DIA.
_____ CHARACTERS ON _____ BACKGROUND

FASTENERS (#10-24 X 1.000) SPANNERHEAD

ELEVATOR CONTROLLER INFORMATION

MANUFACTURER: MCE
MODEL:
FIXTURE VOLTAGE: 24 VDC
POLARITY

EXISTING FACEPLATE DIMENSIONS

HEIGHT:
WIDTH:
TOP AFF:
BOTTOM AFF:
BOX DEPTH:

LANTERN INFORMATION

UP: GREEN (LED)
DOWN: RED (LED)
HALL CHIME: SERIAL PT#59419124
CAR CHIME:

HALL EQUIPMENT INFORMATION

MATERIAL: 16 GA. (TYPE 304) STAINLESS STEEL
FINISH: NO. 4 BRUSHED
ENGRAVING FONT:
BEVEL 15°: NO
PREWIRE: NO

ASME / STATE / FIRE CODE

FIRE YEAR CODE: 2019
FIRE KEYCODE:

DIGITAL PI INFORMATION

DISPLAY COLOR: WHITE
LENS COLOR: GRAY
SIGNAL VOLTAGE:
SIGNAL FORMAT:
NO. OF INPUTS:
SCROLLING: (IH320 ONLY)

INNOVATION INDUSTRIES INC
3500 E. MAIN ST., RUSSELLVILLE, AR 72802
(479) 968-2232 FAX (479) 968-7986

COMPANY / JOB NAME
ELEVATOR SERVICES INC. / ANN ARBOR VA S4

LOCATION:
ANN ARBOR, MI

PURCHASE ORDER NO.
0002186

JOB NO.	WORK ORDER NO.	QUOTE NO.
		010325SD9
SALES REP: SD	FILE NAME 010325SD9E	SHEET NO. 5 OF 7
REV B-REVISED PRELIMINARY		DRAWN BY: TCM
DO NOT SCALE		SIZE B

	APPROVED AS DRAWN:	APPROVED BY:
	APPROVED AS NOTED:	
	REVISE AND RESUBMIT:	DATE:

LANDING	ELEVATOR S4 FLOOR MARKINGS FRONT	REAR	SIDE
60			
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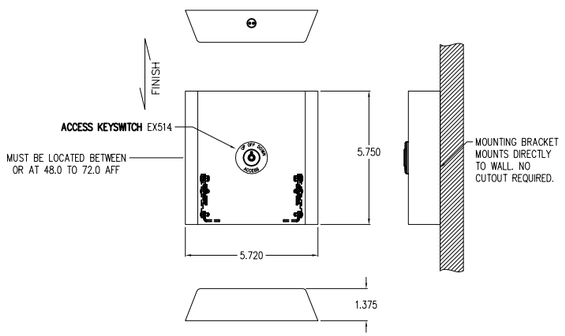
7	6		
6	5		
5	4		
4	3		
3	2		
2	*1		
1	B		

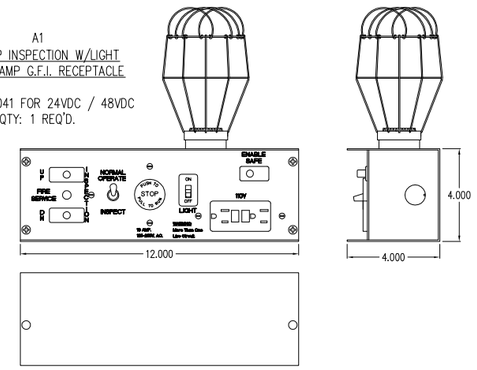
HAS1
"PH" SERIES HINGED SURFACE MOUNT HALL ACCESS STATION
QTY: 2 REQ'D
REQ'D @ FLOOR B,8



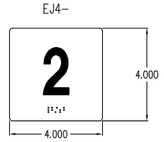
KEYSWITCHES ON FACEPLATE						
SWITCH IDENTIFICATION	OPERATING POSITIONS	KEY REMOVE POSITION	MAINTAINED POSITIONS	MOMEN. POS.	MOUNT	HALO COLOR
ACCESS	UP-OFF-DN	OFF	OFF	UP-DN	HOR	BLACK

A1
CAR TOP INSPECTION W/LIGHT
WITH 15 AMP G.F.I. RECEPTACLE

PT# 61100041 FOR 24VDC / 48VDC
QTY: 1 REQ'D.

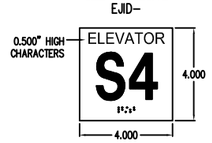


A2
JAMB TAGS
STAINLESS CHARACTERS
ON BLACK BACKGROUND
SELF-ADHESIVE
EJ4-



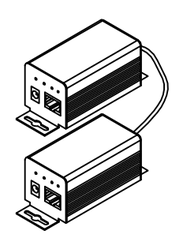
ELEVATOR	QTY	FLOORS
S4	2 EA	B,B1,*1,2,3,4,5,6,7,8

A3
ELEVATOR NUMBER TAGS
STAINLESS CHARACTERS
ON BLACK BACKGROUND
SELF-ADHESIVE
EJID-

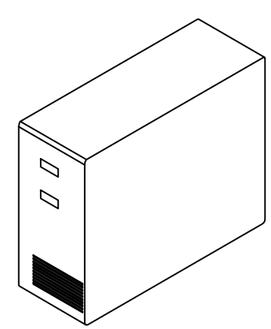


ELEVATOR NUMBER	QTY
S4	4 EA

A4
WUR-COM ETHERNET EXTENDER
QTY: 1 REQ'D.
PART# 11-10072111



A5
WUR-COM UPS/BATTERY BACKUP
QTY: 1 REQ'D.
PART# 11-10071546



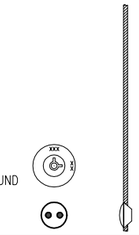
DEVICE STYLE

_____ PUSHBUTTON _____
_____ INDICATOR
PB-2 KEYSWITCH
_____ TOGGLE

BRAILLE ADA COMPLIANT:

_____ 1.250 [31.75 mm] SQ.
_____ CUSTOM FISHTAIL BRAILLE
_____ OVAL SURROUND 2.750 X 1.500
_____ 1.375 [34.93 mm] DIA.
_____ CHARACTERS ON _____ BACKGROUND

FASTENERS (#10-24 X 1.000) SPANNERHEAD



ELEVATOR CONTROLLER INFORMATION

MANUFACTURER: MCE
MODEL:
FIXTURE VOLTAGE: 24 VDC
POLARITY

EXISTING FACEPLATE DIMENSIONS

HEIGHT:
WIDTH:
TOP AFF:
BOTTOM AFF:
BOX DEPTH:

LANTERN INFORMATION

UP:
DOWN:
HALL CHIME:
CAR CHIME:

HALL EQUIPMENT INFORMATION

MATERIAL: 16 GA. (TYPE 304) STAINLESS STEEL
FINISH: NO. 4 BRUSHED
ENGRAVING FONT:
BEVEL 15°: NO
PREWIRE: NO

ASME / STATE / FIRE CODE

FIRE YEAR CODE: 2019
FIRE KEYCODE:

DIGITAL PI INFORMATION

DISPLAY COLOR:
LENS COLOR:
SIGNAL VOLTAGE:
SIGNAL FORMAT:
NO. OF INPUTS:
SCROLLING: (IH320 ONLY)

INNOVATION INDUSTRIES INC
3500 E. MAIN ST., RUSSELLVILLE, AR 72802
(479) 968-2232 FAX (479) 968-7986

COMPANY / JOB NAME: ELEVATOR SERVICES INC. / ANN ARBOR VA S4		
LOCATION: ANN ARBOR, MI		
PURCHASE ORDER NO.: 0002186		
JOB NO.	WORK ORDER NO.	QUOTE NO. 010325SD9
SALES REP: SD	FILE NAME 010325SD9F	SHEET NO. 6 OF 7
REV B-REVISED PRELIMINARY		DRAWN BY: TCM
DO NOT SCALE		SIZE B

APPROVED AS DRAWN:	APPROVED BY:
APPROVED AS NOTED:	
REVISE AND RESUBMIT:	DATE:

VOICE ANNUNCIATOR INFORMATION

LANDING	ELEVATOR S4 FLOOR MARKINGS FRONT	REAR	SIDE
60			
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6	4		
5	3		
4	2		
3	*1		
2	B1		
1		B	

1. SPECIFY SIGNAL VOLTAGE AND FORMAT.

SIGNAL VOLTAGE:
- ☐ = POSITIVE 6-20 VAC/DC, 24 VAC
- ☐ = POSITIVE 24-48 VDC, 48 VAC
- ☐ = POSITIVE 120 VAC
- ☐ = POSITIVE 125 VDC
- ☐ = NEGATIVE 6-20 VDC
- ☐ = NEGATIVE 24-48 VDC
- ☐ = NEGATIVE 125 VDC
- ■ = MICROCOMM

SIGNAL FORMAT:
- ☐ = ONE LINE/FLOOR
- ☐ = BINARY (START @ 000001)
- ☐ = BINARY (START @ 000000)
- ☐ = UNITS & TENS
- ☐ = GRAY CODE
- ☐ = INVERTED BINARY
- ☐ = SPECIAL
- ☐ = MICROCOMM

2. SPECIFY ELEVATOR CONTROLLER MANUFACTURER AND MODEL.

MFG: MCE MODEL: _____

3. DOES CONTROLLER HAVE CE INTERFACE BOARD INSTALLED

YES _____ NO _____

4. SPECIFY MALE OR FEMALE VOICE.

MALE _____ FEMALE _____

5. SPECIFY LANGUAGE.

ENGLISH _____ OTHER _____

6. STANDARD MESSAGES.

MESSAGE #	DESCRIPTION	ACTUAL MESSAGE
1	FIRE MAIN	THIS ELEVATOR IS NOW IN FIRE RETURN. WHEN DOORS OPEN, PLEASE EXIT THE BUILDING IN A SAFE AND ORDERLY MANNER.
2	FIRE ALT	THIS ELEVATOR IS NOW IN FIRE RETURN. WHEN DOORS OPEN, PLEASE EXIT THE BUILDING IN A SAFE AND ORDERLY MANNER.
3	NUDGING	PLEASE STAND CLEAR OF THE CLOSING DOORS.
4	IND SVC	THIS ELEVATOR IS ON INDEPENDENT SERVICE.
5	OVERLOAD	THIS CAR IS ON OVERLOAD STATUS. PLEASE REMOVE PART OF THE LOAD TO RESUME SERVICE.
6	EMRG PWR	THIS ELEVATOR IS NOW ON EMERGENCY POWER AND THE CAR IS RETURNING TO THE MAIN LEVEL.
7	INSP	THIS CAR IS NOW ON INSPECTION SERVICE.
8	SEISMIC	THE SEISMIC SENSOR HAS BEEN ACTIVATED. PLEASE EXIT THE ELEVATOR WHEN THE DOORS OPEN.
* ___	CUSTOM	_____
* ___	CUSTOM	_____
* ___	CUSTOM	_____
* ___	CUSTOM	_____

* CUSTOM MESSAGES REQUIRE THE CUSTOMER TO ADVISE THE MESSAGE NUMBER. THIS INFORMATION MUST COME FROM THE ELEVATOR CONTROLLER MANUFACTURER.

7. MODEL TYPE:

- X VM3541-MMIL (MICRO COMM)
- ___ VS3541-XXBL (STAND ALONE)
- ___ VM3541-MMDL (NEMA 4 MICRO COMM)
- ___ VS3541-XXDL (NEMA 4 STAND ALONE)

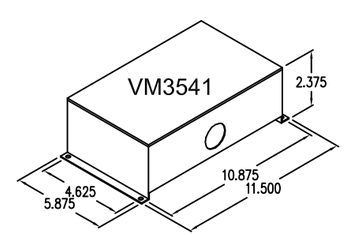
8. FLOORS TO BE ANNOUNCED.

- ___ FLOOR 8
- ___ FLOOR 7
- ___ FLOOR 6
- ___ FLOOR 5
- ___ FLOOR 4
- ___ FLOOR 3
- ___ FLOOR 2
- ___ FLOOR 1
- ___ 1ST BASEMENT
- ___ BASEMENT
- ___ GOING UP
- ___ GOING DOWN

* IF FLOORS ARE TO BE SKIPPED, CUSTOMER TO ADVISE NUMBER OF EXPRESS ZONES.

THE CONTROL UNIT TO BE MOUNTED ON CAR TOP
AND MUST BE WITHIN 20' OF SPEAKER OR DAMAGE WILL RESULT.

C1
MAIN CAR STATION
ELEVATOR S4



****PLEASE NOTE****

CUSTOM MESSAGES WILL REQUIRE AN ADDITIONAL PROGRAMMING CHARGE

	APPROVED AS DRAWN:	APPROVED BY: _____
	APPROVED AS NOTED:	
	REVISE AND RESUBMIT:	DATE: _____

INNOVATION INDUSTRIES INC
3500 E. MAIN ST., RUSSELLVILLE, AR 72802
(479) 968-2232 FAX (479) 968-7986

COMPANY / JOB NAME: ELEVATOR SERVICES INC. / ANN ARBOR VA S4		
LOCATION: ANN ARBOR, MI		
PURCHASE ORDER NO.: 0002186		
JOB NO.	WORK ORDER NO.	QUOTE NO. 010325SD9
SALES REP: SD	FILE NAME: 010325SD9G	SHEET NO. 7 OF 7
REV B-REVISED PRELIMINARY		DRAWN BY: TCM
DO NOT SCALE		SIZE B

BRUrope FiberCore

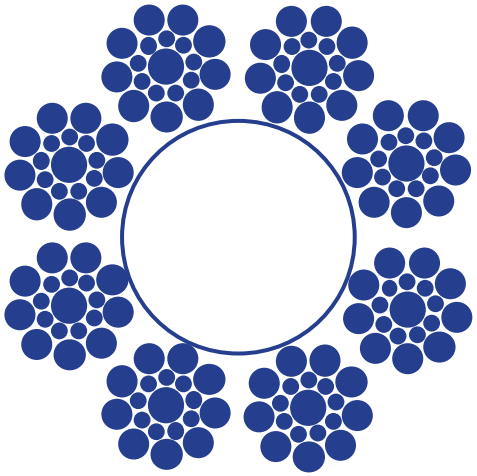
BRUGG Lifting

8X19

Fiber Core Rope NFC (Sisal) 8 Strands

For high demands on elongation also under difficult installation conditions

Recommended for all groove shapes



Elastic elongation	Permanent elongation	Lifting height*
0,101%	**0,290**%	**≤ 75** m **≤ 250** ft

item number	rope ø		breaking load min.		weight		construction
	mm	**in**	**kN**	**lbs**	**kg/100m**	**lb/ft**	
63999	8.0	5/16	30,5	6857	21,70	0,1458	8x19S-NFC 1370/1770 U sZ (RRL)
78748	9.0	–	38,2	8588	27,00	0,1814	8x19S-NFC 1370/1770 U sZ (RRL)
63980	9.5	3/8	42,5	9554	30,30	0,2036	8x19S-NFC 1370/1770 U sZ (RRL)
78677	9.5	3/8	50,3	11308	30,30	0,2036	8x19S-NFC 1770 U zZ (RLL)
60544	10.0	–	47,2	10611	33,60	0,2258	8x19S-NFC 1370/1770 U sZ (RRL)
63996	11.0	7/16	58,6	13178	41,60	0,2796	8x19S-NFC 1370/1770 U sZ (RRL)
62928	12.0	–	71,0	15968	50,60	0,3400	8x19S-NFC 1370/1770 U sZ (RRL)
61618	12.7	1/2	79,4	17850	54,00	0,3629	8x19S-NFC 1570 U sZ (RRL)
63981	12.7	1/2	75,9	17063	54,00	0,3629	8x19S-NFC 1370/1770 U sZ (RRL)
78680	12.7	1/2	89,5	20120	54,00	0,3629	8x19S-NFC 1770 U sZ (RRL)
61577	13.0	–	81,9	18412	58,20	0,3911	8x19S-NFC 1370/1770 U sZ (RRL)
10675	15.5	–	115,2	25898	81,60	0,5484	8x19S-NFC 1370/1770 U sZ (RRL)
63989	15.88	5/8	119,6	26886	85.30	0,5730	8x19S-NFC 1370/1770 U sZ (RRL)
63990	15.88	5/8	125,4	28189	85,30	0,5730	8x19S-NFC 1570 U sZ (RRL)
29361	16.0	–	128,2	28821	87,16	0,5857	8x19S-NFC 1570 U sZ (RRL)
63982	16.0	–	122,3	27494	87,16	0,5857	8x19S-NFC 1370/1770 U sZ (RRL)
77820	16.0	–	144,4	32463	87,16	0,5857	8x19S-NFC 1770 U sZ (RRL)
73101	18.0	–	158,7	35677	113,16	0,7604	8x19S-NFC 1370/1770 U sZ (RRL)
77507	19.0	–	172,1	38689	122,80	0,8252	8x19S-NFC 1370/1770 U sZ (RRL)

Further nominal strengths and/or diameters (including imperial dimensions) on request. Rope diameter-tolerances according to EN12385-5 / ISO 4344.

* The defined lifting height is based on an elevator with a 1:1 suspension and is only indicative. It does not replace the exact calculation according to the system specifications.

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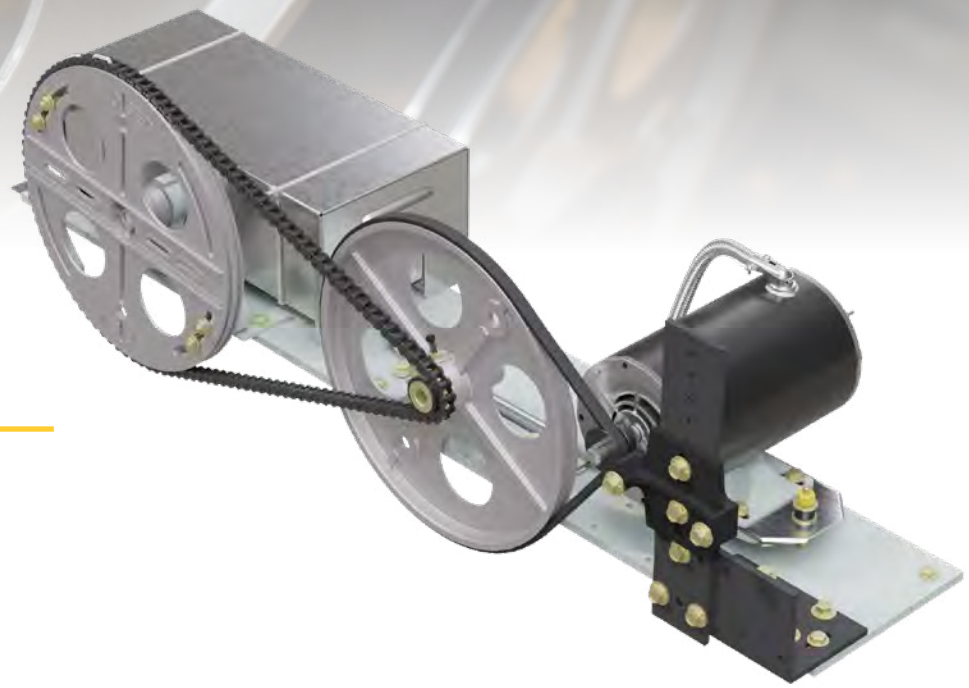
No warranty for printing errors or errors. If not agreed otherwise, our general conditions of sale and delivery are valid.

MOVFR II

Door Operator



PERFORMANCE THAT'S TOUGH TO BEAT

Intelligent design. Legendary reliability.

BENEFITS

THE SOLID ANSWER FOR DEMANDING APPLICATIONS:

- Heavy-duty 1/2 HP, 230 volt AC motor (3-phase, 60 Hz, 1140 RPM) can quietly handle any application
- Handheld parameter management enables replicate door for fast and easy motion tuning with true 'Plug-and-Play' door detector installation
- PC board with a variable frequency (VVVF) closed loop drive provides consistent door timing with no need for an encoder
- Programs quickly and easily (parameter unit and device work together)
- Adapts to all OEM and independent cabs and doors with optical closed loop feedback
- 'Plug-and-Play' door protection

GAL CANADA
A VANTAGE Company

GAL
A VANTAGE Company

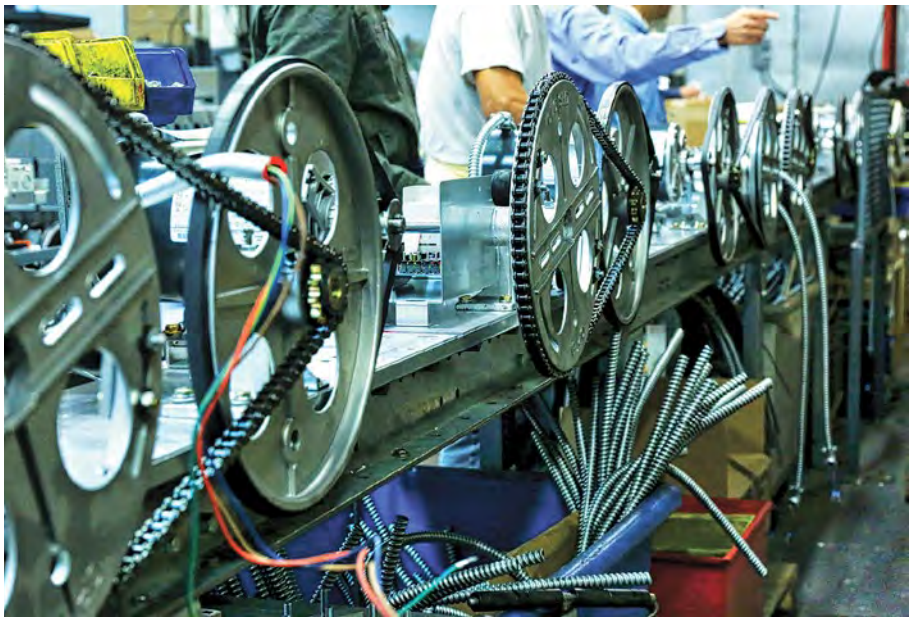
6500 Gottardo Court
Mississauga, ON L5T 2A2
Ph: 416.747.7967
Fax: 41.-747.9035
info@galcanada.com
www.galcanada.com

50 E. 153rd St.
Bronx, NY 10451-2104
Ph: 718.292.9000
Fax: 718.292.2034
info@gal.com
www.gal.com

REGIONAL SERVICE CENTERS
Miami – 877.241.9354
Chicago – 877.300.5830
Los Angeles – 877.300.5816
New York – 347.226.4555
Toronto – 888.425.2262

STANDARD FEATURES

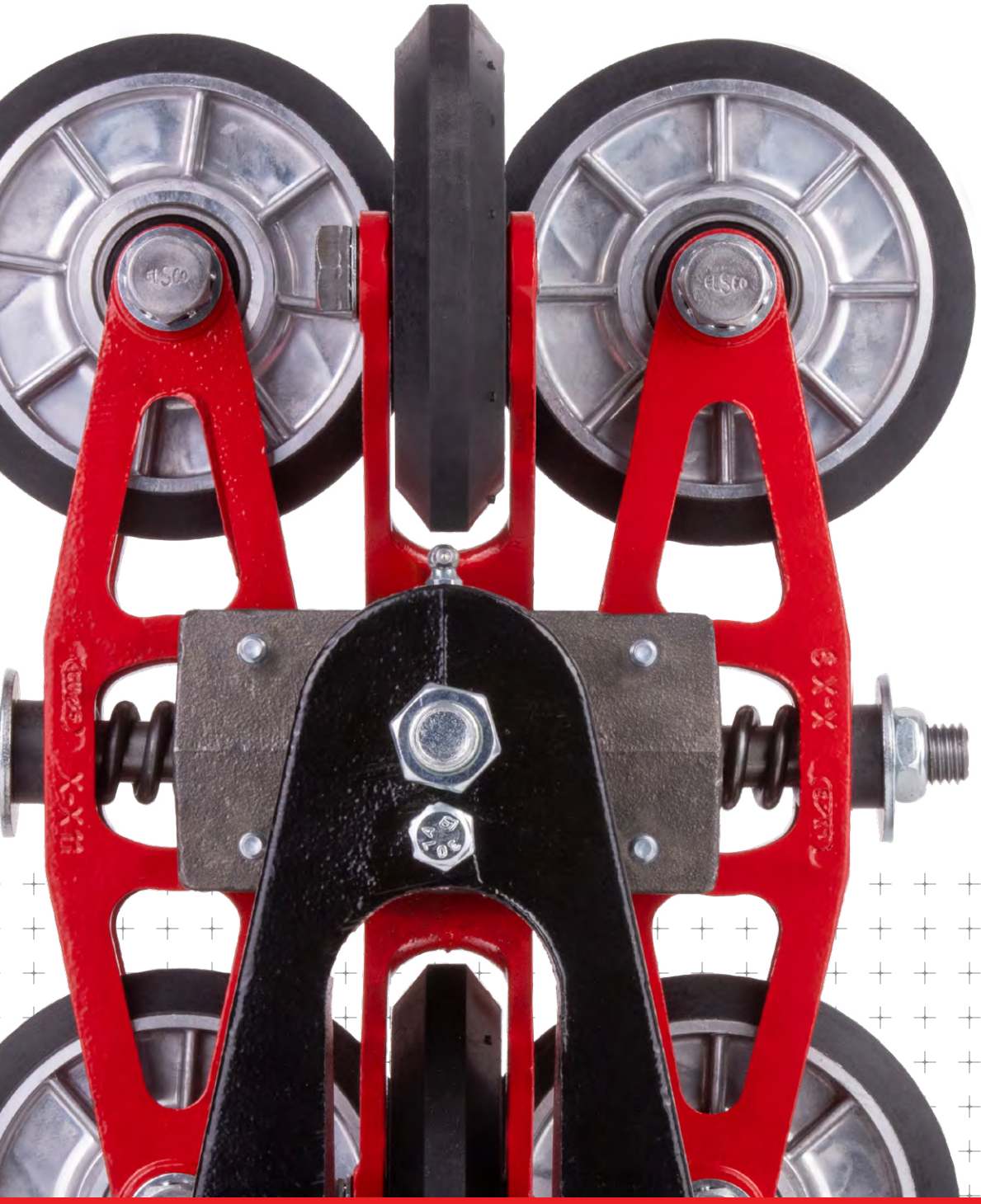
- Quick and easy LED display keypad programming allows complete control for all speeds, torques, acceleration, and deceleration
- Download operating parameters for one operator for easy upload to others, great for multi-car banks
- Electronic door position optical cams with sequential lights displaying speed and door positions
- Over current re-open and DPM fault monitor signals
- Universal inputs accept control signals from dry contacts to signal voltages from 12-230 V, AC or DC
- Output contacts including door open limit, door close limit, re-open signal, and DPM signal are rated at 230V, 10 amp AC
- Portable PU04 unit lets you easily modify preset parameter values, capable of holding 5 complete sets (1 working set, 4 defaults)
- Available for left- and right-hand doors (center-parting doors use a variation of the left-hand door operator)
- Drives Available: 220 VAC/115 VAC



OPTIONAL FEATURES

- Optional 'heavy door' input to maximize door performance and still meet the kinetic energy requirements found is ASME A17.1 - 2000 + codes
- Water-resistant model available: Controls encased to gasketed housing, motor rated for 'wash down' duty, water-resistant grommets for wiring
- GAL offers Formula Systems and Tri-tronics edges which plug directly into MOVFR Operator, saving hours on installation

VANTAGE
THE POWER TO MOVE



MODEL A

The industry's gold standard for elevator ride quality for over 70 years

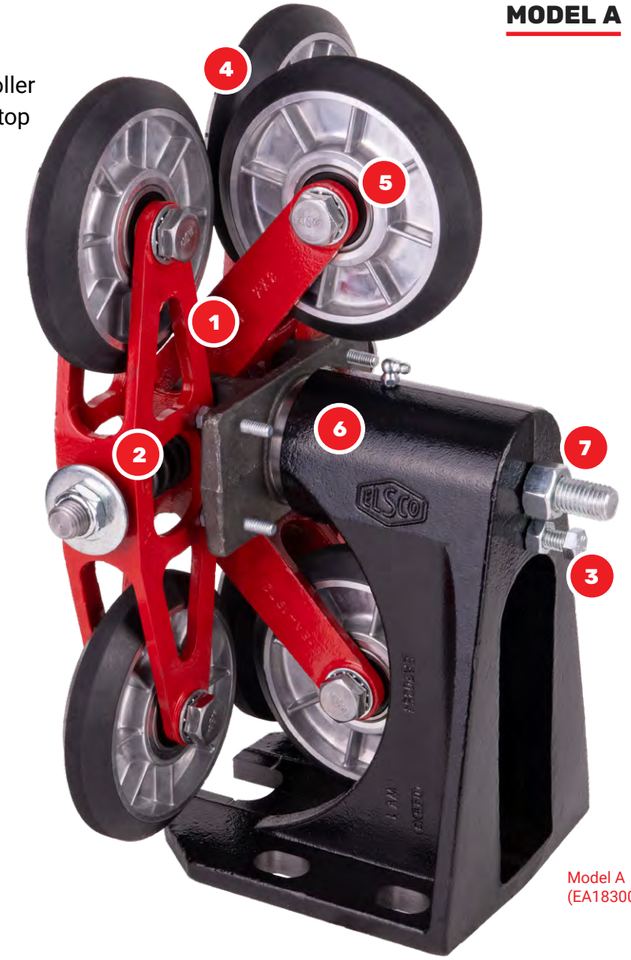
The 6-wheel adjustable Model A roller guide delivers an exceptionally wide application range allowing for higher speeds and capacities while delivering ELSCO's trusted quality and performance.

Designed for elevator cars up to 800 fpm or 10,000 lbs capacity in mid- to high-rise buildings.

U.S. Patent No. 11,407, 615

The Model A is a high-speed 6-wheel paired-roller guide with spring suspension, an adjustable stop on the face arm and six premium 6” diameter neoprene rollers.

Engineered and tested to meet ASME A17.1/ CSA B44 and EN81 standards, ELSCO’s Model A roller guide is constructed from precision machined, ductile iron castings and is assembled using quality parts to ensure your elevator ride will **GO UNNOTICED.**



Model A
(EA18300)

OPTIMIZED RIDE QUALITY AND FLOAT

1 Tandem-Roller Arms

- 6-wheels give added stability that can easily handle higher loads associated with service and hospital cars or higher speed passenger cars
- 6-wheel design steps over misaligned rail joints minimizing in-car vibration at high speeds
- Compensate for hoistway imperfections that affect elevator ride performance

2 Fully Adjustable Stabilizing Springs

- Independently adjust the pre-load force of the rollers on the rail to minimize bumps and vibration and ensure optimal ride quality
- Allow for maximum adjustability to optimize reduction in peak-to-peak lateral forces which improves ride quality

3 Adjustable Stop

- On the face arm allows control of the overall float of the elevator car between the rails in a post-to-post direction
- Allows for precise final adjustments to deal with troublesome hoistway issues

MINIMIZED NOISE AND VIBRATION

4 Neoprene Rubber Roller Wheels

- Precision manufactured using ELSCO’s proprietary neoprene rubber tread compound
- 65A durometer tread dampens vibration and reduces noise even in high-speed applications
- Precisely ground tread profile provides a balanced and concentric roller
- High-memory tread characteristics prevent flat spotting

5 Precision Ball Bearings

- Dual bearing construction provides the roller extra stability, ensuring a true ride, free of noise and vibration
- Precision bearing press process during assembly at ELSCO ensures perfect fit, alignment and quality

DURABLE, ENGINEERED DESIGN

6 Robust Casting and Design Features

- Precisely machined castings are tested to meet applicable codes and standards ensuring the guides provide a lifetime of reliable performance

QUICKER AND EASIER INSTALLATION

7 Innovative Design Features

- Patented adjustment features are designed for quick and simple installation, reducing installation costs
- Hub adjustment and adjustable stop assemblies are pre-installed at the factory

COUNTERWEIGHT APPLICATIONS

- Recommended for use as a counterweight with the Express-6 at speeds up to 1,400 fpm, and capacities from 3,000 - 6,000 lbs, and with the Express-3 at speeds up to 2,000 fpm and capacities from 3,000 - 4,000 lbs

APPLICATIONS TABLE

Find the elevator type and verify the platform falls within the platform dimensions for that elevator. Next, find the intersection of the elevator’s speed and capacity to confirm the roller guide is recommended for the application.

CAPACITY	PASSENGER CAR (PLATFORM UP TO 10’ WIDE X 8’ DEEP/ (3050 mm X 2440 mm))							HOSPITAL CAR (PLATFORM UP TO 6’ WIDE X 10’ DEEP/ (1830 mm X 3050 mm))							FREIGHT/SERVICE CAR (PLATFORM UP TO 10’ WIDE X 8’ DEEP/ (3050 mm X 2440 mm))						
fpm	200	300	400	500	600	700	800	200	300	400	500	600	700	800	200	300	400	500	600	700	800
m/s	1.0	1.5	2.0	2.5	3.0	3.5	4.0	1.0	1.5	2.0	2.5	3.0	3.5	4.0	1.0	1.5	2.0	2.5	3.0	3.5	4.0
≤3,500 lbs 1,500 kg				■	■	■	■				■	■	■	■		■	■	■	■	■	■
4,000 lbs 1,800 kg				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
4,500 lbs 2,000 kg	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
5,000 lbs 2,300 kg	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
6,000 lbs 2,700 kg	■	■	■	■	■	■	■	■	▲	■	■	■			■	▲	■	■	■		
7,000 lbs 3,200 kg	■	■	■	■	■	■	■	■	▲	■	■	■			■	▲	■	■	■		
8,000 lbs 3,600 kg	●	■						●							▲						
9,000 lbs 4,100 kg	●	■						●							●						
10,000 lbs 4,500 kg	●	■						●							●						

Not every elevator is the same. If your application is not indicated in the red shaded area, please contact ELSCO Customer Service for expert application assistance.

▲ Green Polyurethane

● Red Polyurethane

ROLLER GUIDE RAIL COMPATIBILITY

● Compatible ◐ Check Clearance

PART #	RAIL SIZES								
ISO/ASME	T89 / 8#	T90	T114 / 11#	T125 / 12#	T127-1 / 12#	T127-2 / 15#	T140-1 / 18#	T140-2 / 22#	T140-3 / 30#
WIDTH	5/8” (16 mm)	5/8” (16 mm)	5/8” (16 mm)	5/8” (16 mm)	5/8” (16 mm)	5/8” (16 mm)	3/4” (19 mm)	1-1/8” (28.6 mm)	1-1/4” (31.75 mm)
EA18300		●	●	●	●	●	●		
EA18930								●	●

RECOMMENDATIONS AND SPECIAL CONDITIONS

- In most applications the recommended counterweight roller guide for use with a Model A is the Model C
- In slower applications check there is pit clearance for the roller guide height
- For elevators with higher capacity and speed applications, or if the car is heavily leaning or imbalanced, contact ELSCO Customer Service for guide selection recommendations

OPTIONAL ACCESSORIES

Flex-Mount™ Adjustable Adaptor Plate

(EA07100)

Cover Plate Kit

(EA18333)

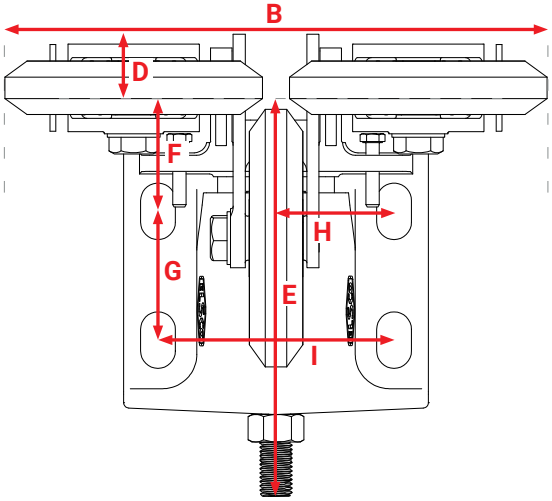
SEISMIC ACCESSORIES

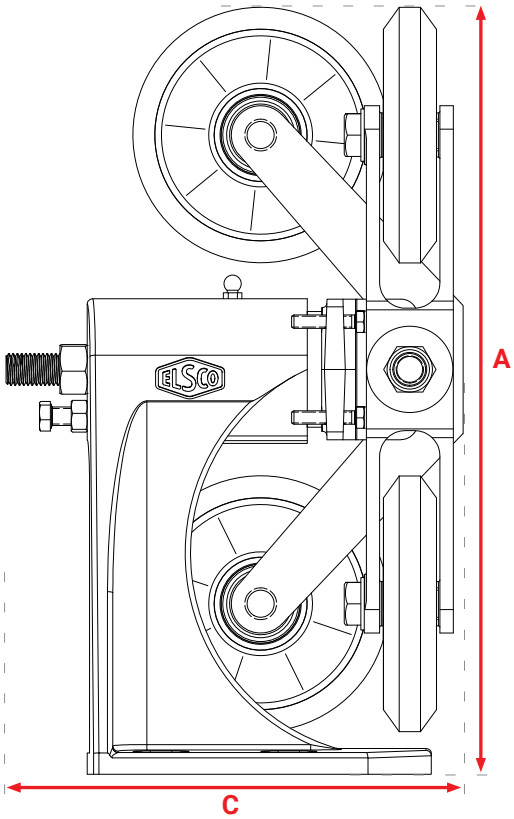
Seismic plates must be installed if the guide is used to meet the elevator seismic requirements per ASME A17.1/CSA B44.19, section 8.4 in seismic risk zones 2 or greater. Seismic Flex-Mount™ Adjustable Adapter Plates can be used when mounting to pre-existing bolt patterns.

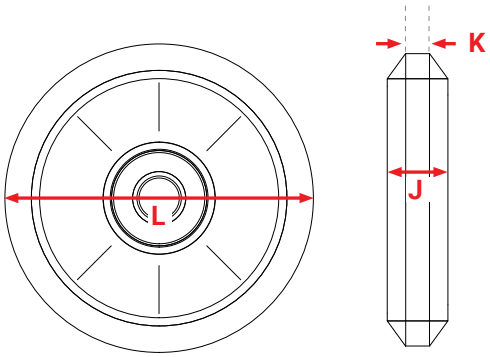
	RAIL SIZES						
ISO/ASME	T114 / 11#	T125 / 12#	T127-1 / 12#	T127-2 / 15#	T140-1 / 18#	T140-2 / 22#	T140-3 / 30#
Seismic Plate	EB06015 ◐			EB06015	EB06018	EB06022	EB06030
Seismic Flex-Mount™ Adjustable Adapter Plate	EA07100-S-15 ◐			EA07100-S-15	EA07100-S-18	EA07100-S-22	EA07100-S-30

CRITICAL DIMENSIONS

GUIDE MEASUREMENTS	
A - Height, overall	18" (457 mm)
Height, overall with optional Flex-Mount™	21" (532 mm)
Height, overall with optional Seismic Plate	18-1/2" (470 mm)
Height, minimum clearance with optional Cover Plate	18-5/8" (472 mm)
B - Width, overall with 3/4" rail	12-3/4" (324 mm)
Width, overall with 30# rail	13-1/4" (337 mm)
C - Depth, overall	11" (279 mm)
D - Distance from front to face of rail	1-13/16" (45 mm)
E - Depth, from face of rail	9-1/4" (235 mm)
BOLT HOLE LOCATIONS	
F - Depth, from face of rail to center of bolt hole	2-3/8" (60 mm)
G - Distance between bolts on center, y-axis (post-to-post)	3" (76 mm)
H - Distance from center of face wheel to center of bolt	2-3/4" (70 mm)
I - Distance between bolts on center, x-axis	5-1/2" (140 mm)
MOUNTING BOLT HOLES	
Number of bolt holes	4
Bolt hole dimensions	1-5/16" x 13/16" (33 mm x 21 mm)
WEIGHT	
Each guide	57.9 lbs (26.3 kg)
ROLLER WHEELS	
J - Width at hub	1-1/4" (32 mm)
K - Neoprene tread width - face & side arm	1/2" (12.7 mm)
L - Diameter	6" (152 mm)
Bearing I.D.	0.7874" (20 mm)
Runout (total indicator reading)	0.002" (0.051 mm)







Scan here to learn more about the Model A Roller Guide and other ELSCO products.

© ELSCO 2023 | Model A Product Brochure | 0003 U.S. Patent No.11,407,615

iControl Traveler and Hoistway Cable

Streamline iControl installation and maximize efficiency

iControl traveler and hoistway cables simplify wiring between the cartop and the controller, helping to prevent wiring errors and shortening installation time. In addition to consistent color coding to identify similar signal types, each conductor is stamped every six inches with the appropriate input or output label; the same label used on the iBox connection.

iControl cables are available in two diameters (depending upon conductor count). The hoistway cable connects iControl to the hoistway midpoint box, where it connects to the like-sized traveler cable which connects from the midpoint box to the cartop. The traveler cable has an additional conductor, a coaxial cable, and is sheathed in a protective jacket.

Pull sheets are provided — and come in handy when noting codes for extra wires — but aren't critical to the task since each standard conductor is already pre-labeled.

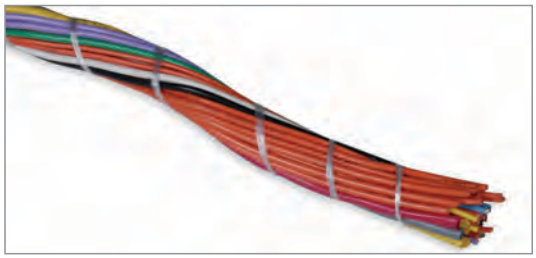
Typical label stamping at controller end

APPLICATIONS

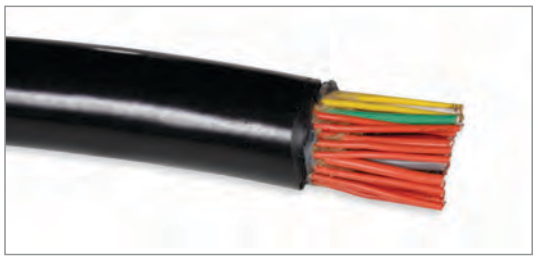
- Modernization or new construction
- MCE iControl elevator controllers

BENEFITS

- Save time during installation
- Save time during future service or troubleshooting
- Just the right number of conductors — smaller, easier-to-hang cables



iControl hoistway cable



iControl traveler cable

iControl Traveler and Hoistway Cable

Cable conductor identification

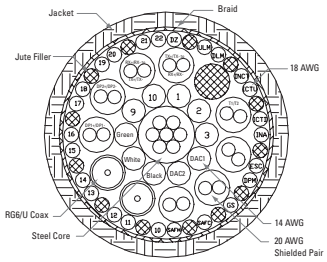
TLS-C-G2 Terminal Limit Switches are simple and rugged, designed to stand up to hoistway conditions. Magnetically actuated switches require no maintenance, eliminating the cycle of cleaning, adjusting, and lubricating necessary to keep traditional mechanical switches* working properly. The table below lists the number of switches required for particular car speeds before and after A17.1-2000 compliance.

14 Gauge		20 Gauge Shielded Pairs			18 Gauge	
ID	Color	ID	Wire Color	Sleeve	ID	Color
1–3	Orange	DP1+/DP1-	Blk/Wht	Blue	DZ	Orange
DAC1	Orange	DP2+/DP2-	Blk/Wht	Black	ULM	Orange
DAC2	Orange	RX+/RX-, TX+/TX-	Blk/Wht	Orange	DLM	Orange
Blank	Black	TX+/TX-, RX+/RX-	Blk/Wht	Yellow	INCT	Orange
Blank	White	T1/T2	Blk/Wht	Gray	ICTU	Orange
Blank	Green	None/None	Blk/Wht	Red	ICTD	Orange
9–10 (14)	Lavender	None/None	Blk/Wht	Tan	INA	Orange
		None/None	Blk/Wht	Pink	ESC	Orange
					DPM	Orange
					GS	Orange
					SAFC	Orange
					SAFH	Orange
					10–20 (10–19)	Yellow
					21–22 (20–29)	Tan
					30–40	Brown
					41–47	Blue

Information in parenthesis ( ) or orange cells applies to larger cables only.

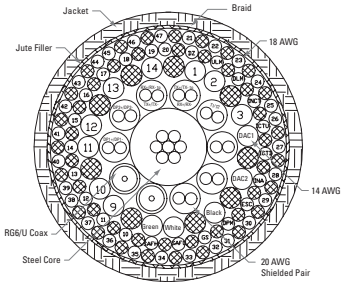
iControl Hoistway Cable (small) —
10 x 14AWG, 25 x 18AWG, 8 x 20AWG/SH PR

iControl Traveler Cable (small) —
10 x 14AWG, 25 x 18AWG, 8 x 20AWG/SH PR, 2 x RG6U coax



iControl Hoistway Cable (large) —
14 x 14AWG, 50 x 18AWG, 8 x 20AWG/SH PR

iControl Traveler Cable (large) —
14 x 14AWG, 50 x 18AWG, 8 x 20AWG/SH PR, 2 x RG6U coax



TRAVELER CABLE SPECIFICATIONS

- Support strand: 1/4" (6.4 mm)
- Breaking strength: 7,000 lbs. (3,175 kg)
- Conductors: Stranded bare soft drawn copper
- Insulation: 60°C, 300 volt rated
- Coax: RG6/U, 75-ohm, UL, sweep-tested Nominal attenuation: 0.4dB/100' @ 4 MHz
- Shielded pairs: 2 twisted 20AWG conductors, copper braid shield, PVC jacket
- Steel support: Preformed, flexible, zinc coated steel wire rope. PVC insulated, rayon braid.
- Braid: Rayon, 95% coverage of core
- Jacket: 60°C PVC with wear-resistant surface. Retards flame, inhibits oxidation, resists effect sunlight, water, oil, weathering, most solvents and chemicals.
- Diameter:
  Small: 1.480 inches (38 mm)
  Large: 1.850 inches (50 mm)
- Cable net weight:
  Small: 1,186 lbs./1,000 ft (1,765 kg/km)
  Large: 1,724 lbs./1,000 ft (2,566 kg/km)

HOISTWAY CABLE SPECIFICATIONS

- Conductors: Stranded bare soft drawn copper
- Shielded pairs: 2 twisted 20AWG conductors, copper braid shield, PVC jacket
- Binder: Helically wound synthetic string for maximum strength
- Diameter:
  Small: 1.01 inches (27.6 mm)
  Large: 1.32 inches (33.5 mm)
- Cable net weight:
  Small: 736 lbs./1,000 ft (1,095 kg/km)
  Large: 1,043 lbs./1,000 ft (1,552 kg/km)

VHA Infection Control Risk Assessment for Construction, Renovation and Maintenance

Introductory Information and Instructions

Use this template as a baseline for performing facility Infection Control Risk Assessments (ICRAs) for construction, renovation, and maintenance work (referred to as the "activity" in this document). The template provides minimum requirements for categorizing activity types and patient risk to determine the level of precautions needed to prevent infection risks. Facilities may customize this template to incorporate site-specific information and/or to add more stringent criteria.

This VHA ICRA template pertains specifically to infection prevention. It must be used if required by the VHA Pre-Construction Risk Assessment (PCRA) for the activity. *NOTE: The PCRA addresses other activity-related safety concerns (e.g., vibration, noise, hazardous materials) outside the scope of the ICRA.*

To complete the template:

1. Use **Table 1** to identify the category of the construction, renovation and/or maintenance activity.
2. Use **Table 2** to identify the areas affected by the activity.
3. Use **Table 3** to identify the overall patient risk category that will be affected by the activity.
4. Use **Table 4** to determine the level of infection prevention and control precautions needed for the activity.

Once all 4 steps above are completed: Refer to **Table 5** for the minimum required control measures for the level of infection prevention and control precautions needed for the activity. Refer to **Table 6** for the minimum infection prevention and control measures required on completion of the activity.

PERMIT: See the last page of this document for a fillable permit form to be used for posting at the activity site as needed.

Table 1 - Construction, Renovation, and/or Maintenance Activity Category

NOTE: *If any of the bulleted criteria in a higher activity category pertains to the work that will be done (even if the other criteria are in a lower category), use the higher activity category for the VHA ICRA.*

Activity Category determined from Table 1 (*A, B, C, or D*): C

Category A	**Inspection and/or facility upkeep generally defined as follows**: • Work can be completed in a single shift, not to exceed 10 hours. • Patients and/or employees may be in the area depending on the activity. • Work that does not create dust or debris. • Removal of ceiling tile or access to mechanical or electrical chase for visual inspection limited to 1 tile per 50 square feet with limited exposure time (not to exceed an hour for each tile) within the shift. • Minor interior updates (e.g., replacing floor or ceiling tiles, carpentry work to include hanging signage, and painting without sanding) that do not create dust or debris. • Limited building system maintenance such as basic plumbing on potable systems (e.g., faucet replacement) or basic electrical work such as replacement of light bulbs, receptacles, or switches.
Category B	**General maintenance and repair work generally defined as follows:** • Prolonged inspection and work that may take longer than a single shift but not exceeding a week. • Patients and employees are not to be in the area until activity is completed. • Work that creates minimal dust and debris.

	• Interior finish or surface repairs, updates, or modifications such as repair of firewalls and barriers, and new flooring that produces minimal dust and debris. Controlled sanding activities (e.g., wet or dry sanding) that produce minimal dust and debris. • Plumbing work such as installation or replacement of a single fixture or piping for a single fixture. Any work on sanitary plumbing including snaking of drains. • Electrical work such as installation of cabling/wiring/conduit for a single device, installation of new device such as a light fixture that produces minimal dust and debris. • Air Handler and/or fan shutdown/startup and HVAC work such as replacement of a single diffuser, single terminal unit or a single device that produces minimal dust and debris.
Category C	**Small-scale construction, renovation, or maintenance generally defined as follows**: • Work requiring longer than a single week to complete but not exceeding 6 months. • Patients and employees are not to be in the area until activity is completed. • Demolition/removal of preexisting floor covering, casework, lay-in ceiling, or other architectural elements. • Demolition/removal of more than 32 ft^2 of drywall/framing, hard ceilings, and doors/framing and minimal infrastructure such as electrical circuits and branch piping. • Installation of new walls, ceilings and doors including framing, drywall/plaster and associated work. • Plumbing work such as the installation of new sinks, showers and toilets and associated plumbing. • Shut down of sections of potable water systems. • Electrical work such as installation of conduit and wire for lighting, receptacles and switches for an area, the installation of conduit and wire for new devices such as terminal units, fans etc. • Modification of existing fire alarm and suppression systems. • Mechanical work such as the installation of ductwork, diffusers, and terminal units for an area.

Category D	**Large-scale construction, renovation, or maintenance generally defined as follows**:
	• Work exceeding 6 months in duration.
	• Patients and employees are not to be in the area until activity is completed.
	• Large-scale demolition of building components and infrastructure including removal of multiple doors, walls, framing, ceilings, flooring, piping, electrical and HVAC.
	• The installation building components such as new walls, ceilings and doors including framing, drywall and associated plaster work.
	• Plumbing work such as the installation of:
	  o new medical gas systems,
	  o steam/heating hot water, condensate systems,
	  o multiple sinks, showers and toilets including associated plumbing.
	• Shutdown of potable water, steam/heating hot water, condensate, and medical gas systems.
	• Electrical work such as installation of electrical feeders, distribution panels, conduit and wire for lighting, receptacles and switches for an area, the installation of conduit and wire for new devices such as terminal units, fans etc.
	• Installation of fire alarm and suppression systems.
	• Electrical shutdown of multiple panels.
	• Mechanical work such as the installation of air handling equipment, associated ductwork, diffusers, heat exchangers, terminal units and controls.

Table 2 - Affected Area Assessment

Identify the areas and associated patients that will be affected by the construction/renovation/maintenance activity (see the Figure for a visual representation of adjacent affected areas).

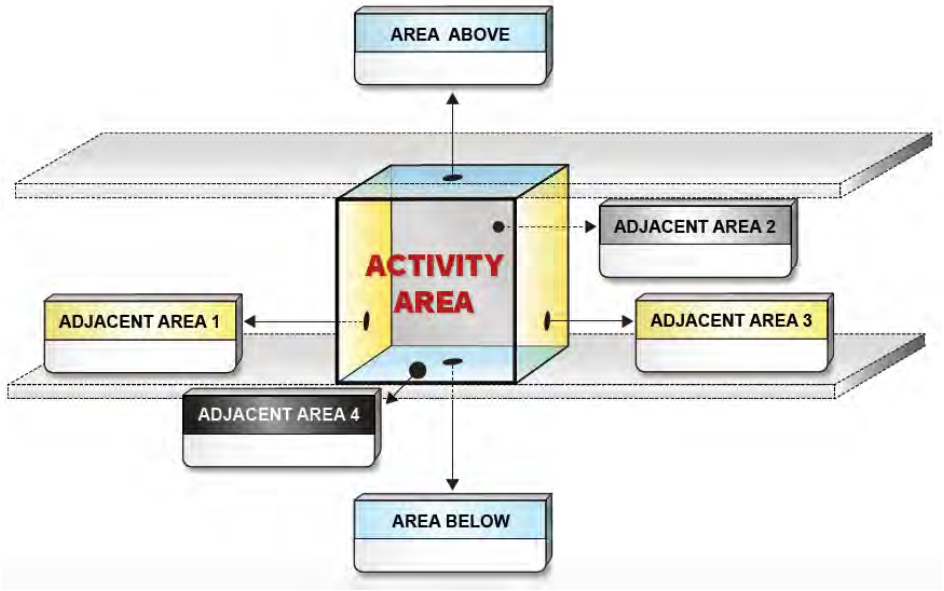


Figure: Isometric drawing of affected area assessment

Area	Service(s)/Type(s) of Area(s) *(e.g., OR, Unit/Ward, Sterile Processing, Administrative, etc.)**	Point of Contact (POC)	POC Contact Information
Activity Area**	Note: Level II throughout with point of generation capture.	VA COR	
Area Above			
Area Below			
Adjacent Area 1			
Adjacent Area 2			
Adjacent Area 3			
Adjacent Area 4			

* There may be more than one Service/type of area for each row. List all.

** List the area(s) in which the construction/renovation/maintenance activity will occur. ***NOTE: When the Activity Category is B, C, or D, the control measures are determined by the Patient Risk in the adjacent affected areas.***

VHA Infection Control Risk Assessment for Construction, Renovation and Maintenance

Table 3 - Patient Risk Category

Using Table 3, identify the patient risk category for each area listed in Table 2. Of the patient risk categories identified, select the one with the greatest risk as the overall Patient Risk Category for the activity.

Overall Patient Risk Category determined from Table 3 (*Low, Medium, High, or Highest*): Low

Low Risk	Medium Risk	High Risk	Highest Risk
Non-patient care areas such as:	Patient care support areas such as:	Patient care areas such as:	Procedural, invasive, sterile support and highly compromised patient care areas such as:
• Public hallways and gathering areas not in clinical areas • Office areas not in clinical areas • Breakrooms not in clinical areas • Bathrooms or locker rooms not in clinical areas • Mechanical/electrical rooms not in clinical areas	• Waiting areas • Clinical engineering (biomedical) • Materials management • Sterile processing department – dirty side • Kitchen, cafeteria, gift shop, coffee shop, and food kiosks	• Patient care rooms and areas, including spinal cord injury units • All acute care units, including mental health • All outpatient units and clinics • Emergency department • Community Living Centers, domiciliaries, and transitional residences • Employee health • Pharmacy – general work zone • Medication rooms and clean utility rooms • Imaging suites – diagnostic imaging • Laboratory	• All transplant units • All intensive care units • All oncology units and chemotherapy/infusion centers • OR theaters and restricted areas • Hemodialysis units • Procedural rooms* • Pharmacy compounding area • Sterile processing department – clean side • Transfusion services • Imaging suites – interventional imaging • Dedicated isolation wards/units for infectious diseases

***** Procedural Rooms are designated for the performance of patient care activities that may require high-level disinfected or sterile instruments and some environmental controls but is not required to be performed with the environmental controls of an operating room (OR). The room is intended for procedures that are performed in an aseptic surgical field and penetrates the protective surfaces of a patient's body (e.g., subcutaneous tissue, mucous membranes, cornea) or entry into or opening of a sterile body cavity. Examples of these spaces include, and are not limited to, Cardiac Catheterization Suites, Electrophysiology Suites, Endovascular/GI Suites, Angio Suites and other spaces which may have high risk patient populations.

Table 4 - Level of Infection Prevention and Control Precautions

Match the Overall Patient Risk Category (*Low, Medium, High, Highest*) determined from Table 3 with the planned Construction/Renovation/Maintenance Activity Category (*A, B, C, D*) from Table 1 to determine the minimum Level of Infection Prevention and Control Precautions (*I, II, III, or IV*) using Table 4 below.

Level of Precautions determined from Table 4 (*I, II, III, or IV*): II

Patient Risk Category	Activity Category			
	A	**B**	**C**	**D**
Low Risk	I	II	II	III
Medium Risk	I	II	III	IV
High Risk	I	II	IV	IV
Highest Risk	II	III	IV	IV

An infection prevention and control permit is required for Level III and Level IV. Consult with Infection Prevention and Control for Level I and Level II.

Table 5 - Required Infection Prevention and Control Measures, by Level of Precautions

Controls defined below for the Level of Precautions identified for the activity must be in place before the activity begins and maintained until work is completed and the area is activated. Control measures for each Precaution Level must also include the control measures in the preceding Level(s).

As the activity progresses, a full re-evaluation of remaining activity type and patient risk is required prior to downgrading the Level of Precautions.

Level of Precautions	Control Measures
Level I	1. Perform work activity in a manner that does not create dust. 2. Immediately replace any ceiling tile, close access panels, etc., upon completion of work. 3. Any materials and equipment being brought into the facility must be free of contaminants and loose material.
Level II	**All control measures in Level I and the following:** 1. Provide active means to control airborne dust from dispersing into occupied areas and/or water mist surface to control dust (e.g., Mobile Dust Containment Cart or some other system). 2. Ensure worker clothing is clean and free of visible dust before leaving the work area. 3. Remove or isolate air diffusers (supply and return) to protect the HVAC system from dust and reduce air turbulence. Rebalance system to address diffuser isolation.

	4. When the work involves or impacts potable water systems including stagnation due to reduced usage, the piping shall be flushed twice a week or isolated from the main system. 5. Seal doors to prevent dust migration. 6. Contain all trash and debris in the work area. Perform daily cleaning and disposal of trash (covered) from work area using an identified exit route. 7. Any equipment, tools, or materials removed from the work area must be in sealed containers and/or cleaned of dust and debris prior to removal from the area. 8. Nonporous/smooth and cleanable containers (with a hard lid) must be used to transport trash and debris from the construction areas. These containers must be damp-wiped cleaned and free of visible dust/debris before leaving the contained work area. 9. Install a sticky (dust collection) mat at entrance of contained work area based on facility policy. Sticky mats must be changed routinely and when visibly soiled. 10. Maintain clean surroundings when area is not contained by damp mopping or HEPA vacuuming surfaces at least daily.
Level III	**<u>All control measures in Levels I and II</u> and the following:** 1. Ensure availability of equipment for cleaning hands. 2. Construct and complete critical barriers meeting NFPA 241 requirements. Barriers must extend to the ceiling or if ceiling tile is removed, to the deck above. 3. All (plastic or hard) barrier construction activities must be completed in a manner that prevents dust release. Plastic barriers must be effectively affixed to floor and ceiling (or floor/roof deck above) and secure from movement or damage. 4. Seal all penetrations in containment barriers, including floors and ceiling, using approved materials (UL schedule firestop if applicable for barrier type). 5. Maintain .01 inches /water gauge negative pressurization of the entire workspace by use of HEPA exhaust air systems directed outdoors, or comply with the alternative method outlined in Appendix A of this document. These control measures must be maintained continuously 24/7 for the duration of the project. HEPA filtered exhaust if discharged directly to the outdoors must be at a distance of 25 feet or greater from entrances, air intakes and operable windows. Exhausting discharged air into shared or recirculating HVAC systems, or other shared exhaust systems (e.g., bathroom exhaust) is <u>prohibited</u>. 6. Install a differential pressure sensing device (e.g., magnehelic, manometer, or digital monitoring) on exterior of work containment to continually monitor and document negative pressurization. The “ball in the wall” or similar apparatus are <u>not acceptable</u>.
Level IV	**<u>All control measures in Levels I, II and III</u> and the following:** 1. Barriers must be hard barriers unless temporary to install final barrier. 2. Containment must include an anteroom to ensure pressure control. Anteroom must be large enough for equipment staging, cart cleaning, workers’ PPE and cleaning. 3. Worker clothing and/or PPE must be removed or clean and free of visible dust before leaving the work area anteroom. HEPA vacuuming of clothing or use of cover suits is acceptable. 4. Workers must wear shoe covers or have a method to clean shoes in anteroom. Shoe covers must be removed prior to exiting the anteroom to the occupied space (non-work area). Damaged shoe covers must be changed immediately.

Table 6 - Minimum Infection Prevention and Control Measures Required Upon Completion of the Activity

Controls defined below shall be completed upon completion of the activity and inspected prior to terminating measures defined in Table 5.

Level of Precautions	Measures
Levels I - II	**Cleaning:** 1. Clean work areas including all environmental surfaces, high horizontal surfaces and flooring materials. 2. Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces. **HVAC Systems:** 1. Remove isolation of HVAC system in areas where work is being performed. Verify that HVAC systems are clean and operational. 2. Verify the HVAC systems meet original airflow and air exchange design specifications. **Water systems:** 1. Until the potable water system is activated and in use, flushing shall continue at least twice per week in accordance with VHA Directive 1061.
Levels III - IV	Construction areas must be inspected by an infection preventionist and engineering representative (and others as determined by the facility) for final activity/project close out and removal of infection prevention and control measures. **Work Area Cleaning:** 1. Clean work areas including all environmental surfaces, high horizontal surfaces and flooring materials. 2. Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces. **Removal of Critical Barriers:** 1. Critical barriers must remain in place during all work involving drywall removal, creation of dust and activities beyond simple touch-up work. The barrier may NOT be removed until a work area cleaning has been performed. Additional cleaning may be needed after removal of barrier. 2. All (plastic or hard) barrier removal activities must be completed in a manner that prevents dust release. Use the following precautions when removing hard barriers: i. Carefully remove screws and painter tape. ii. If dust will be generated during screw removal, use hand-held HEPA vacuum. iii. Drywall cutting is prohibited during removal process. iv. Clean all stud tracks with HEPA vacuum before removing outer hard barrier. v. Use a plastic barrier to enclose area if dust could be generated. **Negative Air Requirements:** 1. The use of negative air must be designed to remove contaminants from the work area. 2. Negative air devices (fans, filters, monitoring and documentation equipment) must remain operational at all times and in place for a period after completion of dust creating activities to remove contaminants from the work area and before removal of critical barriers. **HVAC systems:** 1. Upon removal of critical barriers, remove isolation of HVAC system in areas where work is being performed. 2. Verify that HVAC systems are clean and operational. 3. Verify and document through a TAB the HVAC systems meets original airflow and air exchange design specifications. **Water systems:** 1. Until the potable water system is activated and in use, flushing shall continue at least twice per week in accordance with VHA Directive 1061.

Infection Prevention and Control Construction/Renovation/Maintenance Permit

This page must be posted at the entrance to the project area for Level III and Level IV activities.

Unique permit number:			
Location of construction/renovation/maintenance			
Project manager		Project start date	
Contact phone number		Completion date	
Contractor		Permit expiration date	

Activity Category (*A, B, C, or D*)	C	Overall Patient Risk Category (*Low, Medium, High, or Highest*)	Low	Level of Infection Prevention and Control Precautions (*I, II, III, or IV*)	II

Level of Precautions	Control measures to be in place for the duration of the activity *(Check the box for the activity's Level of Precautions to indicate the Control Measures)*
Level I ☑	1. Perform work activity in a manner that does not create dust. 2. Immediately replace any ceiling tile, close access panels, etc., upon completion of work. 3. Any materials and equipment being brought into the facility must be free of contaminants and loose material.
Level II ☑	**All control measures in Level I and the following:** 1. Provide active means to control airborne dust from dispersing into occupied areas and/or water mist surface to control dust (e.g., Mobile Dust Containment Cart or some other system). 2. Ensure worker clothing is clean and free of visible dust before leaving the work area. 3. Remove or isolate air diffusers (supply and return) to protect the HVAC system from dust and reduce air turbulence. Rebalance system to address diffuser isolation. 4. When the work involves or impacts potable water systems including stagnation due to reduced usage, the piping shall be flushed twice a week or isolated from the main system 5. Seal doors, to prevent dust migration. 6. Contain all trash and debris in the work area. Perform daily cleaning and disposal of trash (covered) from work area using an identified exit route. 7. Any equipment, tools, or materials removed from the work area must be in sealed containers and/or cleaned of dust and debris prior to removal from the area. 8. Nonporous/smooth and cleanable containers (with a hard lid) must be used to transport trash and debris from the construction areas. These containers must be damp-wiped cleaned and free of visible dust/debris before leaving the contained work area. 9. Install a sticky (dust collection) mat at entrance of contained work area based on facility policy. Sticky mats must be changed routinely and when visibly soiled. 10. Maintain clean surroundings when area is not contained by damp mopping or HEPA vacuuming surfaces at least daily.
Level III ☐	**All control measures in Levels I and II and the following:** 1. Ensure availability of equipment for cleaning hands. 2. Construct and complete critical barriers meeting NFPA 241 requirements. Barriers must extend to the ceiling or if ceiling tile is removed, to the deck above. 3. All (plastic or hard) barrier construction activities must be completed in a manner that prevents dust release. Plastic barriers must be effectively affixed to floor and ceiling (or floor/roof deck above) and secure from movement or damage. 4. Seal all penetrations in containment barriers, including floors and ceiling, using approved materials (UL schedule firestop if applicable for barrier type). 5. Maintain .01 inches /water gauge negative pressurization of the entire workspace by use of HEPA exhaust air systems directed outdoors, or comply with the alternative method outline in Appendix A of the VHA ICRA template. These control measures must be maintained continuously 24/7 for the duration of the project. Exhausting discharged air into shared or recirculating HVAC systems, or other shared exhaust systems (e.g., bathroom exhaust) is prohibited. **Check box to indicate exhaust method:** Exterior ☐ Alternative Interior Method ☐ 6. Install a differential pressure sensing device (e.g., magnehelic, manometer, or digital monitoring) on exterior of work containment to continually monitor and document negative pressurization. The "ball in the wall" or similar apparatus are not acceptable.
Level IV ☐	**All control measures in Levels I, II and III and the following:** 1. Barriers must be hard barriers unless temporary to install final barrier. 2. Containment must include an anteroom to ensure pressure control, Anteroom must be large enough for equipment staging, cart cleaning, workers' PPE and cleaning. 3. Worker clothing and/or PPE must be removed or clean and free of visible dust before leaving the work area anteroom. HEPA vacuuming of clothing or use of cover suits is acceptable. 4. Workers must wear shoe covers or have a method to clean shoes in anteroom Shoe covers must be removed prior to exiting the anteroom to the occupied space (non-work area). Damaged shoe covers must be changed immediately.

Additional requirements:			
Project Manager signature		Date	
Infection Preventionist signature		Date	

Appendix A: Alternative To Outdoor Exhaust Requirements

This Appendix provides an equivalent ICRA control measure to requirements detailed in this VHA ICRA template (Table 5 Level III, item 5) that would allow interior construction space exhaust.

Interior Construction Space Exhaust:

If the facility is not able to exhaust to the building exterior, the Healthcare Environment and Facilities program office has identified an alternate industry-recognized standard interior exhaust procedure that is accepted as providing an equivalent level of infection prevention and control (IPC), and safety. The alternate interior exhaust procedure is implemented by completing the following:

a. If exhaust is directed indoors, then the system must be HEPA filtered. Prior to start of work, including assembly of the ICRA barriers, initial baseline air sampling measurements for particulate levels must be taken in the planned area of discharge. Once containment is erected and completed, HEPA filtration must then be verified by particulate measurement, using a particle counter with multi-channel capabilities to measure down to 0.3 microns, to confirm that the discharge of the HEPA unit does not exceed the baseline particulate count of the area to which the exhaust is directed. Verification must continue at least three times per day (once every 8 hours), 7 days per week, during the use of the negative air machine and HEPA filter. Any exceedance must trigger a work stoppage and an immediate response and resolution. All particulate measurements, including the baseline measurement, must be documented and retrievable.
b. To accommodate the sampling, the negative air pressure machine must be fitted with a 2 ft section of rigid ductwork at the discharge. The sample port for monitoring must be in the rigid ductwork section.
c. Vapor generating processes must be assessed and appropriate filtration must be installed to mitigate transmission to the facility.
d. Engineering must do a complete flow and pressure analysis and document the area to which the air is being discharged to ensure the flow and pressure relationships in that area are not being adversely impacted by the additional flow. Ideally, this is done as part of the construction package to ensure the design is implementable and no additional HVAC changes are required to accommodate the exhaust from the negative air equipment.
e. Install device on exterior of work containment to continually monitor negative pressurization. To ensure proper pressure is continuously maintained, the device(s) shall have a visual pressure indicator, data collection and alarm.
f. Exhaust must be directed to Low Risk areas as defined in Table 3 in this VHA ICRA template. Ideally this discharge must be located so as not to impinge on high traffic areas or create a nuisance with noise or excessive airflow.
   NOTE: *Exhaust into shared or recirculating HVAC systems, or other shared exhaust systems (e.g., bathroom exhaust) is not acceptable.*