DEPARTMENT OF VETERANS AFFAIRS
VHA MASTER SPECIFICATIONS

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SECTION 01 00 00
GENERAL REQUIREMENTS

1.1 SAFETY REQUIREMENTS

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

1.2 GENERAL INTENTION

A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for Correcting Mental Health Safety Deficiencies as required by drawings and specifications.

B. 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: Work includes general construction, alterations and construction and certain other Items such as Electrical Work including all labor, material, equipment, and supervision to perform the required Electrical construction work on this project.

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.

C. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the Contracting officers representative (COR) for the purpose of security inspections of every area of project including toolboxes and parked machines and take any emergency action.
2. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation. See Section 08 71 00, DOOR HARDWARE, and coordinate.

C. Document Control:

1. Before starting any work, the General Contractor/Subcontractors 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.

E. 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. No permits shall be issued for General Contractor and its employees for parking. Contractor and Subcontractors shall use street parking or the Cook County Juvenile Court Parking Facility. Non-compliant vehicles will be cited.

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 workdays. 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 capped at suitable places where shown; or, in absence of such indication, where directed by COR. All such actions shall be coordinated with the COR or Utility Company involved:

1. 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.

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.

2. To ensure such executions, Contractor shall furnish the COR with a schedule of approximate 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.

J. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction area indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by COR.

K. 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, 14 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 14 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.

L. 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. Those which are indicated to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged at the main, branch or panel they originate from. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.

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

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.

1.7 ALTERATIONS

A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR of areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, to the Contracting Officer. This report shall list by rooms and spaces:

1. Existing condition and types of resilient flooring, doors, windows, walls, and other surfaces not required to be altered throughout affected areas of building.

2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, shades, etc., required by drawings to be either reused or relocated, or both.

3. Shall note any discrepancies between drawings and existing conditions at site.

4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur, and which have been agreed upon by Contractor and COR.

B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COR, to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4).

C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and COR together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls, and other surfaces as compared with conditions of same as noted in first condition survey report:

1. Re-survey report shall also list any damage caused by Contractor to such flooring and other surfaces, despite protection measures; and will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workers in executing work of this contract.

D. Protection: Provide the following protective measures:

1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.

2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled, and equipment moved and/or relocated.

3. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

1.8 DISPOSAL AND RETENTION

A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:

1. Reserved items which are to remain property of the Government are identified by attached tags as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by COR.

2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.

3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government. When rooms and spaces are vacated by the

Department of Veterans Affairs during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.

1.9 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).

1.10 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.

1.11 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 four sets 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 roofs, HVAC balancing, pumps, motors, transformers and for all commissioned systems such as fire protection and alarm systems, sprinkler systems and lightning protection 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.

1. 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. Pre-Warranty Conference: Prior to contract completion, and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and

other details deemed necessary by the Contracting Officer for the execution of the construction warranty will be established/ reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contract will be located within the local service area of the warranted construction, be continuously available and be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in conjunction with other portions of this provision.

D. Contractor's Response to Construction Warranty Service Requirements:

E. 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 workdays and work continuously to completion or relief.

4. The "Construction Warranty Service Priority List" is as follows:

A. Code 1-Electrical

1. Power failure (entire area or any building operational after 1600 hours).

2. Security lights.

3. Smoke detectors.

B. Code 2-Electrical

1. Power failure (no power to a room or part of building). Receptacle and lights not operational (in a room or part of building).

C. Code 3-Electrical

1. Exterior lights not operational.

D. Code 3

1. All work not listed above.

F. 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

Warranty Tags
Construction Contractor
Address
Telephone number
Warranty Contact
Address
Telephone number
Warranty response time priority code

1.12 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.

1.13 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.

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.

1.14 TEMPORARY TOILETS

Provide where directed, (for use of all Contractor's workers) ample temporary sanitary toilet accommodations with suitable sewer and water connections; or, when approved by COR, provide suitable dry closets where directed. Keep such places clean and free from flies and all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.

1.15 AVAILABILITY AND USE OF UTILITY SERVICES

A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.

B. The Contractor, at Contractor's expense and in a workmanlike manner, in compliance with code and as satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution

lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia and repair restore the infrastructure as required.

C. Contractor shall install meters at Contractor's expense and furnish the Medical Center a monthly record of the Contractor's usage of electricity as hereinafter specified.

D. Electricity (for Construction and Testing): Furnish all temporary electric services.

1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.

E. Water (for Construction and Testing): Furnish temporary water service.

1. Obtain water by connecting to the Medical Center distribution system. Provide reduced pressure backflow preventer at each connection as per code. Water is available at no cost to the Contractor.

2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at COR discretion) of use of water from Medical Center's system.

1.16 INSTRUCTIONS

A. Contractor shall furnish Maintenance and Operating manuals (hard copies and electronic) and verbal instructions when required by the various sections of the specifications and as hereinafter specified.

B. Manuals: Maintenance and operating manuals and one compact disc (four hard copies and one electronic copy each) for each separate piece of equipment shall be delivered to the COR coincidental with the delivery of the

equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.

C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed training to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the COR and shall be considered concluded only when the COR is satisfied in regard to complete and thorough coverage. The contractor shall submit a course outline with associated material to the COR for review and approval prior to scheduling training to ensure the subject matter covers the expectations of the VA and the contractual requirements. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the COR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

1.17 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.

1.18 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 (one hard copy and one electronic copy each) for each separate piece of equipment shall be delivered to the COR coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.

C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed training to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the COR and shall be considered concluded only when the COR is satisfied in regard to complete and thorough coverage. The contractor shall submit a course outline with associated material to

the COR for review and approval prior to scheduling training to ensure the subject matter covers the expectations of the VA and the contractual requirements. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the COR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

1.19 PHOTOGRAPHIC DOCUMENTATION

A. During the construction period through completion, provide photographic documentation of construction progress and at selected milestones including storage and remote access to the documentation, as per these specifications.

B. Photographic documentation elements:

1. Each digital image shall be taken with a professional grade camera with minimum size of 12 megapixels (MP) capable of producing 200x250mm (8 x 10 inch) prints with a minimum of 2272 x 1704 pixels and 400x500mm (16 x 20 inch) prints with a minimum 2592 x 1944 pixels.
2. Construction progress for all trades shall be tracked at pre-determined intervals, but not less than once every thirty (30) calendar days ("Progressions"). Progression documentation shall track both the exterior and interior construction of the building. Exterior Progressions shall track 360 degrees around the site and each building. Interior Progressions shall track interior improvements beginning when stud work commences and continuing until Project completion.
3. As-built conditions of mechanical, electrical, plumbing and all other systems shall be documented post-inspection and pre-insulation, sheet rock or dry wall installation. This process shall include all finished systems located in the walls and ceilings of all buildings at the Project. Overlapping photographic techniques shall be used to ensure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings.
4. As-built finished conditions of the interior of each building including floors, ceilings and walls shall be documented at certificate of occupancy or equivalent, or just prior to occupancy, or both, as directed by the COR. Overlapping photographic techniques shall be used to ensure maximum coverage. Indexing and navigation accomplished through

interactive architectural drawings.

5. Miscellaneous events that occur during any Contractor site visit, or events captured by the Department of Veterans Affairs independently, shall be dated, labeled and inserted into a Section in the navigation structure entitled “Slideshows,” allowing this information to be stored in the same “place” as the formal scope.
6. Customizable project-specific digital photographic documentation of other details or milestones.
7. Regular (8 max) interior progressions of all walls of the entire project to begin at time of substantial framed or as directed by the COR through to completion.

8. Detailed Interior exact built overlapping photos of the entire building to include documentation of all mechanical, electrical and plumbing systems in every wall and ceiling, to be conducted after rough-ins are complete, just prior to insulation and or drywall, or as directed by the COR.
9. Finished detailed Interior exact built overlapping photos of all walls, ceilings, and floors to be scheduled by the COR prior to occupancy.
10. In event a greater or lesser number of images than specified above are required by the COR, adjustment in contract price will be made in accordance with clause entitled "CHANGES" (FAR 52.243-4).

C. Upon completion of the project, final copies of the documentation (the “Permanent Record”) shall be provided in an electronic media format, typically a DVD or external hard-drive. On-line access terminates upon delivery of the Permanent Record.

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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 will develop a fully Resource loaded (cost) Network Analysis System (NAS) plan/diagram and computer generated schedule demonstrating fulfillment of the entire contract requirements, will keep the plan and computer generated schedule up-to-date in accordance with the specification requirements of this section and will utilize the plan for scheduling, coordinating, mitigating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers) and verification of every Periodic Progress Schedule Updates and Progress Payment Submission of the work under this contract.

1.2 PROJECT SCHEDULER:

A. Designate a qualified 3rd-party scheduling consultant who will develop and maintain the project schedule.

B. The scheduling consultant must have five (5) years of experience as a lead project scheduler or previous scheduling experience on at least three (3) projects of similar size and scope.

C. The scheduling consultant must be prepared to discuss, in detail, the proposed sequence of work and methods of operation, and how that information will be communicated through the progress schedule at the preconstruction meeting.

D. The scheduling consultant is required to attend a monthly schedule meeting and make site visits to prepare, develop, and maintain the progress schedules

1.3 SUBMITTALS

A. Initial Schedule:

1. Submit an initial schedule within 7 calendar days after Notice to Proceed (NTP).
   a. Include full schedule details for the first 60 calendar days of work starting on the NTP date and show the schedule ending on or before the Contract Completion Date (CCD).

b. Provide a summary bar chart schedule (acceptable formats include, but are not limited to, Microsoft Excel, Microsoft Project, Oracle Primavera P6, and Gantt Chart).
c. Show the proposed sequence, durations, early and late start dates for major work activities.
d. Show the proposed calendar dates for starting and finishing initial contract activities including, but not limited to, set up of construction site, site layouts, travel routes, waste, and staffing areas.

2. Conduct a schedule review meeting with the Government within 14 calendar days after NTP. At this meeting, plan to discuss the proposed schedule for the entire project, including both the detailed first 60-day period covered by the initial schedule as well as the following summary schedule. If deviations to the staging, phasing, or sequencing required by the contract documents are proposed, be prepared to discuss these deviations.
3. The Government will respond by approving the initial schedule, rejecting the schedule and identifying the reason for rejection, or by asking the contractor for additional information clarifying the proposed schedule activities and timelines.
4. The Government will use the approved initial schedule to monitor progress until the baseline schedule is approved.
5. The Government may withhold progress payments until the initial schedule is approved.

B. Schedule of Costs.

1. No more than 30 calendar days after receipt of the Notice to Proceed, prepare and submit a schedule of costs to the Government for review, in accordance with the technical and schedule submittal requirements listed in this is specification.
2. The approved Schedule of Costs will serve as a tool in addition to the required monthly schedule update to determine progress payments to the Contractor for work completed.
3. costs shown on the Schedule of Costs must represent true costs and the work activities/events match the project schedule work activities/events. The VA Contracting Officers Representative (VA COR) may require the

Contractor to submit its original estimate sheets or other supporting documentation to substantiate the detailed makeup of the cost schedule.

4. The total costs of all work activities/events listed on the Schedule of Costs must equal the total contract price. The breakdown must include all line items specified in the contract and work activities shown on the schedule.
5. The Contractor is responsible for regularly updating the Schedule of Costs to reflect any approved changes to the contract scope or cost structure. Updates must be submitted for approval to the Contracting Officer to ensure continued accuracy and compliance with contract requirements.
6. Failure to submit or maintain an accurate and approved Schedule of Costs may result in delayed progress payments and potential penalties as outlined in the contract agreement.
7. All documentation related to the Schedule of Costs, including original estimate sheets and cost substantiation documents, must be maintained and made available for review upon request by the Contracting Officer or VA COR.

C. Baseline Schedule.

1. No more than 30 calendar days after approval of the initial schedule, prepare and submit a baseline schedule to the Government for review, in accordance with the technical and schedule submittal requirements listed in this specification.
2. The Government will respond by accepting the baseline schedule, rejecting the schedule and identifying the reason for rejection, or by asking for more information.
3. Address the reasons for rejection or provide the information requested and resubmit the revised baseline schedule no more than 10 calendar days after the Government’s response.
4. The Government may withhold progress payments until the baseline schedule is approved.
5. No stored material work activities will be shown or approved be on the baseline schedule.
6. The Baseline Schedule Critical Path of the project shall be limited to:
   a. No more than 20% of the work activities shall be on the critical and near-critical path(s). Critical path is defined as activities with

zero (0) day total float. Near-Critical path(s) is defined as activities with one (1) to twenty (20) days of total float.

b. Multiple Critical paths will not be allowed.

7. The Baseline Schedule shall contain sufficient detail such that no more than 5% of work activities have durations exceeding 20 work days, in accordance with DCMA 14-point Schedule Assessment Guidelines.

D. Monthly Schedule Update.

1. Prepare and submit a monthly schedule update to the Government that depicts the status of the project as of the end of the month, in accordance with the technical and schedule submittal requirements listed in this specification.
2. The update must reflect a new data date, work performed up to, but not including, the new data date, and the plan for completing the project.
3. Submit the schedule update by the first Monday of the following month.
4. The Government may withhold progress payments until the monthly schedule update is approved.
5. Each monthly schedule update must be submitted with the associated schedule log.

E. Revised Schedule.

1. The Government has the right to request a revised schedule.
2. Circumstances leading to such a request include, but are not limited to:
   a. A projected or forecasted delay to scheduled interim or project completion dates.
   b. A significant difference between the actual sequence or duration of work and that depicted in the schedule.
3. Prepare and submit the revised schedule no more than 10 calendar days after the Government’s request in accordance with the technical and schedule submittal requirements listed in this specification.
4. The Government will respond by accepting the revised schedule, rejecting the schedule and identifying the reasons for rejection, or by requesting more information. Address the reasons for rejection or submit the information requested no more than 10 calendar days after the Government’s request.
5. The Government may withhold progress payments until the revised schedule is approved.

F. Final Schedule.

1. Within 30 calendar days of final acceptance of the project, submit a final schedule with actual start and finish dates for each activity.
2. Include with the submission a certification signed by a principal of the firm stating: "To the best of my knowledge, the enclosed final schedule reflects the actual start and finish dates of the activities contained herein."

G. The Government's approval of any schedule, whether initial, baseline, update, or revised, does not modify the contract or constitute endorsement or validation by the Government of the Contractor's logic, activity durations, or assumptions in creating the schedule. By approving the schedule, the Government does not guarantee that the project can be performed or completed as scheduled. If the Contractor or the Government discover errors after the schedule has been approved, correct the error(s) in the next schedule submission.

1.4 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. Distribute overhead, profit, and general conditions proportionally across all work activities/events along the project's length (critical path). 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 and 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. The sum of each Bid Item work shall equal the value of the bid item in the Contractors' bid.

E. With prior written approval from the Contracting Officer, the Contractor may request payment for suitably stored and maintained materials/equipment that conform to specifications and are ready for installation, in accordance with the provisions in VAAR 852.232 – Article 71 Including NAS-CPM for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION). Requests must include comprehensive documentation, such as invoices, proof of payment, and evidence of secure storage with appropriate insurance. Upon approval, payment for materials will be made in accordance with contract provisions, and title to the materials shall vest in the Owner. The contractor is responsible for replacement of non-confirming or damaged materials at no additional cost to the owner. Payment for stored materials will be reflected on the schedule by cost-loading the delivery activity to represent payment upon material receipt at the site, while the installation activity will be separately cost-loaded to represent payment under completion of installation. These schedule will clearly delineate submittal, procurement, delivery (cost-loaded for stored material payment), and installation (cost-loaded for installed material payment) as distinct activities.

1.5 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, 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.

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 VA COR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will follow review requirements as specified in Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
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.

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.

C. 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.

D. 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 VA COR. 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 VA COR's approval of the Project Schedule.

E. Separate Cost-Loaded Activities for Adjusting and Testing Systems:

1. The CPM shall include separate cost-loaded activities for the adjustment and testing of systems in accordance with the provisions in VAAR 852.232 –Article 71 Including NAS-CPM for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION). The percentages provided shall be used to determine the cost of adjust and test work activities/ events, identifying the value of the work for payment purposes.

1.6 TECHNICAL REQUIREMENTS

A. Software Compatibility Requirements.

1. The Government uses Oracle Primavera P6 Professional and Microsoft Project Professional to schedule and monitor its construction projects.
2. Prepare and maintain the schedule using one of the following software options:
   a. Oracle Primavera P6 Professional (Version 22 or higher unless pre-approved)
   b. Microsoft Project Professional (Version 2021 or Higher)

B. Schedule Requirements.

1. Calculate the schedule using the Retained Logic scheduling option unless written authorization is obtained from the Government to use the Progress Override scheduling option.
2. At least 90% of all schedule activities shall be assigned to Finish-to-Start (FS) relationships.
3. Do not use the following types of logic relationships:
   a. Negative lags
   b. Lead and lag time activities
   c. Start-to-finish or finish-to-finish relationships Open ends. Only the first activity will have no predecessor, and only the last activity will have no successor.

d. Constraints (a limited number of constraints may be used only with the Government’s written authorization).
e. Manually modified dates (manually modify dates may be used only with the Government’s written authorization).

4. For any logic relationships that do not meet the criteria above in 1.6.B.2, the contractor must provide justification for the noncompliance to obtain the Government’s authorization to proceed. If the Government does not provide written authorization, the contractor must resubmit the schedule submission.
5. Include the following work activities, as applicable:
   a. Work to be performed by the contractor, subcontractors, and suppliers.
   b. Work to be performed by the Government, other contractors, and third parties such as permitting authorities or other entities required for completion of the project.
   c. The project start date, scheduled completion date, and other contractually mandated milestones, start and finish dates for phases, and site access or availability dates.
   d. Submittals and Government review and approval of submittals (Reference specification section 01 33 23 for submission requirements).
   e. Fabrication, delivery, installation, testing, and similar activities for materials, equipment, and related items.
   f. Sampling and testing periods.
   g. Settlement or surcharge periods.
   h. Cure periods.
   i. Utility notifications, shutdowns, relocations, and similar activities.
   j. Installation, erection and removal, and similar activities related to temporary systems or structures such as temporary electrical systems or shoring.
   k. Punch list, substantial completion, final cleanup, and similar activities.
   l. Required acceptance testing, inspections, or similar activities.
   m. Durations for receipt of permits or acquisition of rights of way.
6. Define the following attributes for each activity in the schedule:

a. A unique alphanumeric Activity ID.
b. A unique descriptive name, using such clear, concise attributes as work type, location so each activity is easily understood. Avoid name abbreviations or overly long activity names to ensure each activity can be objectively measured and clearly understood by all stakeholders.
c. A duration stated in workdays of no more than 20 workdays unless a longer duration is requested by the contractor and approved by the Government.
d. Uses codes for responsibility, phasing, and staging.

1.7 SCHEDULE SUBMISSION REQUIREMENTS

A. Preparing Schedule on Owner's Database. If the schedule is prepared using My Primavera in the owner's database, then for each schedule submission, submit the following items:

1. A transmittal letter to the owner identifying which schedule in the database is being submitted for review.
2. A narrative report.

B. Preparing Schedule on Separate Database. If the schedule is prepared using Primavera Version 6.0, Primavera for Contractors, or another software compatible with Primavera Version 6.0, then, for each schedule submission, submit the following items:

1. A transmittal letter
2. A narrative report
3. A Primavera Version 6.0 compatible electronic file of the schedule.
4. The critical path in bar chart format (Longest Path sort)
5. Work paths with total float values within 20 workdays of the critical path's total float value in bar chart format. For example, if the critical path has a total float value of zero, then show all the work paths with total float values of 20 or less.
6. An activity network diagram plotted in color, on E-size paper, with each sheet of the plot including a title, match data for diagram correlation, a page number, and a legend. The activity network diagram should only be submitted with schedules with revised relationships or activity durations.
7. An updated schedule log associated with each Monthly Schedule Update.
8. A project S-Curve in both graphical and tabular format, displaying both schedule and cost data.

9. A Predecessor/Successor report with the following items for each activity: Activity ID and description

a.Original duration

b.Remaining duration

c.Calendar ID

d.Predecessors and Successors

e.Early start date

f.Early finish date

g.Late start date

h.Late finish date

i.Total float

j.Relationship type

k.Lags

l.Constraints

C. Preparing Schedule on using Microsoft Project Professional, submit the following items:

1. A transmittal letter

2. A narrative report

3. A Microsoft Project Professional .mpp electronic file of the schedule.

a. The critical path in bar chart format (Longest Path sort)

b. Work paths with total float values within 20 workdays of the critical path’s total float value in bar chart format. For example, if the critical path has a total float value of zero, then show all the work paths with total float values of 20 or less.

c. An activity network diagram plotted in color, on E-size paper, with each sheet of the plot including a title, match data for diagram correlation, a page number, and a legend. The activity network diagram should only be submitted with schedules with revised relationships or activity durations.

d. A project S-Curve in both graphical and tabular format, displaying both schedule and cost data.

e. A Predecessor/Successor report with the following items for each activity:

1. WBS and Task Name

2. Baseline duration

3. Remaining duration

4. Predecessors and Successors

5. Early start date

6. Early finish date
7. Late start date
8. Late finish date
9. Total slack
10. Constraints

f. A Lag report displaying all lags within the project schedule.

D. Narrative Reports for the Initial and Baseline Schedule. For each submission of the initial and baseline schedule provide a narrative report that includes the following information:

1. Explanation of the overall plan to complete the project, including where the work will begin and how the work and crews will flow through the project

2. Use and application of the workdays per week, number of shifts per day, number of hours per shift, holidays observed, and how the schedule accommodates adverse weather days for each month of activity

3. If the project is a multi-year project, then identify the work to be completed in each construction season

4. A statement explaining why the scheduled completion date is forecast to occur before or after the contract completion date.

5. An explanation stating why any of the contract milestone dates are forecast to occur late.

6. A description of problems or issues anticipated

7. A description of anticipated delays, including:

a. Identification of the delayed activity by activity ID and description

b. Type of delay

c. Cause of the delay

d. Effect of the delay on other activities, milestones, and completion dates

e. Identification of the actions needed to avoid or mitigate the delay

f. A description of the critical path

g. A description of work paths with total float values within 20 workdays of the critical path’s total float value. For example, if the critical path has a total float value of zero, then describe all the work paths with total float values of 20 or less.

h. A statement identifying constraints and an explanation of the reason for and purpose of each constraint.

i. A statement describing the status of required permits.

j. The statement describing the reason for the use of each lag.

E. E. Narrative Reports for the Monthly Schedule Update and Revised Schedule. For each submission of the monthly schedule update and revised schedule provide a narrative report that includes the following information:

1. A description of the status of the scheduled completion date (and any contract milestone date(s)) since the last schedule submitted

2. A statement explaining why the scheduled completion date is forecast to occur before or after the contract completion date. An explanation stating why any of the contract milestone dates are forecasted to occur late

3. A description of the work performed since the last schedule update

4. A description of unusual labor, shift, equipment, or material conditions or restrictions encountered or anticipated

5. A description of the problems encountered or anticipated since the last schedule submission

6. A statement that identifies and describes any current and anticipated delays. A discussion of delays in the narrative report does not constitute notice and does not replace the need for the contractor to provide notice as required by the contract. Include the following:

a. Identification of the delayed activity by activity ID and description

b. Type of delay

c. Cause of the delay

d. Effect of the delay on other activities, milestones, and completion dates

e. Identification of the actions needed to avoid or mitigate the delay

f. A description of the critical path

g. A description of changes in the critical path and schedule completion date (for the project or its milestones) from the last schedule submission

h. Descriptions of the status of work paths that have total float values within 20 workdays of the critical path identified in the previous schedule submission

i. Descriptions of work paths with total float values within 20 workdays of the critical path’s total float value. For example, if the critical path has a total float value of negative 25, then show all the near-critical paths with total float values of negative 5 or less.

j. A statement or Schedule Comparison Report that identifies the changes made between the previous schedule submission and the current proposed schedule, including, but not limited to:

1. Data date

2. Completion date
3. Activity code assignments
4. Scheduling options
5. Activity descriptions
6. Added activities
7. Deleted activities
8. Added activity relationships
9. Deleted activity relationships
10. Activity original durations
11. Activity remaining durations
12. Activity actual start and finishes
13. Percent complete
14. Constraints
15. Activity resources
16. Activity costs
17. Activity coding

k. A statement providing the status of pending items, including, but not limited to:

1) Permits
2) Change orders
3) Time extension requests
4) Noncompliance or similar notices indicating deficiencies in the contractor’s performance.

7. Prior to Baseline Schedule Acceptance.

a. At the time of the Pre-Construction Conference, prior to the issuance of the project Notice to Proceed, the Contractor and the Contractor’s Scheduling Consultant will arrange a separate meeting with the Contracting Officer and/or the VA COR to discuss the requirements of this specification in detail. The Contractor and the Contractor’s scheduling consultant, will acknowledge, in writing, their understanding and compliance with the requirement of this specification.

b. With exception of bonds, insurance, and limited mobilization cost associated with preparatory work such as site trailers, staging areas, haul roads etc., the approval of the baseline NAS schedule is a condition precedent to:

1) Processing of contractor's pay request(s) for any construction activities/items of work.
2) Review of any schedule updates.

c. Government review comments on the contractor's schedule will not relieve the contractor from compliance with requirements of this specification section and the remaining contract documents.

1.8 QUALITY ASSURANCE

A. Quality assurance of the schedule must conform to the following standards

1. DCMA 14-point Schedule Assessment Guidelines
2. GAO's Schedule assessment guide - Best Practices for Project Schedules Appendix II.

1.9 PAYMENT TO THE CONTRACTOR

A. Monthly, the contractor shall submit an application and certificate for payment using VA Form 10-6001a 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-CPM for (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 electronic files of the resulting monthly updated schedule, provided in both PDF and native scheduling software formats.

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.

C. Payment for adjust and test activities will be made only after the Contractor has demonstrated that each of the systems is substantially complete and operates as required by the contract. The Contractor must adequately document

1.10 PAYMENT AND PROGRESS REPORTING

A. Monthly schedule update meetings will be held on dates mutually agreed to by the VA COR and the Contractor. Contractor and their scheduling consultant 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 VA COR three work days in advance of the scheduled 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 VA COR with reports in accordance with the Article, PROJECT SCHEDULE REQUIREMENTS, 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 1.3 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 Baseline Schedule, the VA, the General Contractor, its approved CPM Consultant, VA COR, 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.

1.11 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 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 VA Contracting Officer 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.

1.12 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 clearly explained narrative justification, CPM data and supporting evidence as the VA COR 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.

- - - END - - -

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

B. 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.

C. 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. Definitions are provided in VHA Directive 7715 take precedence over those provided here, or in Specification 01 42 16 *Definitions and Abbreviations*, which is also part of this contract.

B. 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.

C. General Contractor, also referred to as Prime Contractor here, is the contractor with whom VA has a contract for this work.

D. 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)).

E. 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.

F. 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.

G. 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.

H. 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.

I. 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.

J. 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.

K. 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.

L. "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.

M. 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.

N. USACE Property and Equipment

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

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

P. 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.

Q. 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.

R. 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).

S. 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 REQUIRMENTS:

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 Facility Safety or 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 accident/incident investigation procedure and identify person(s) responsible to provide the following to the Facility Safety Manager and Contracting Officer Representative (COR):

1. Monthly HS&E Performance Report (Exposure Hours Data);

2. Mishap investigation reports;

3. Project site injury and illness logs;

4. Near-Miss reports;

Note: listing safety data on meeting agenda's does not replace the above-mentioned reporting.

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 VA Facility Safety Manager and 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 Kick-Off conference for acceptance. Work cannot proceed without an accepted APP.

D. Once accepted by the VA Facility Safety Manager and 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 or delegated Construction Safety 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 only be made with the knowledge and concurrence of the VA Facility Safety Manager and Contracting Officer Representative. 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):

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 Facility Safety Manager and Contracting Officer Representative 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 Facility Safety Manager and Contracting Officer Representative 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 VA Facility Safety Manager and Contracting Officer Representative 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. In accordance with FAR Clause 52.236.26 – Preconstruction Conference, a project kickoff meeting shall be held to communicate requirements, project-specific concerns, and the project plan of execution. The Contracting Officer Representative may also call for Preconstruction Conferences for planned portions of the work requiring collaborative planning to avoid quality and safety issues. The Prime Contractor and affected subcontractor project leads are required to attend and actively participate.

B. 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.

C. 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.

D. Deficiencies in the submitted APP will be brought to the attention of the Contractor within 14 days of submittal, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Do not begin work until there is an accepted APP.

1.8 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. This contract involves: (a) work of a long duration or hazardous nature, or (b) performance within a Government facility, that on the advice of VA construction safety representatives involves hazardous operations which might endanger the safety of the public, patients, and/or Government personnel or property, therefore the SSHO, and Superintendent and/or Quality Control Manager, must be separate persons. For multiple shift

operations, a SSHO must be on site throughout each shift. In no case shall subcontractor personnel be allowed to access and work on any VA site without their general contractor's SSHO also being on site.

a. VA may be open to considering allowing the general contractor superintendent to act as the SSHO - conditional on retaining the right for the COR, CSO, or CO to summarily and immediately revoke the privilege as a result of observed performance deficiencies.

B. The Prime Contractor shall provide a Safety oversight team that includes a minimum of one (1) person at each project site, for each shift, to function as the Site Safety and Health Officer (SSHO). The Prime Contractor shall provide a minimum of one "Full-Time" 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 at all times, during construction activities, to implement and administer the Contractor's safety program and government-accepted Accident Prevention Plan. If the SSHO is off-site for a period longer than 8 hours, or one shift, and not exceeding 40 hours, or 5 shifts, a pre-approved Alternate Safety Officer shall be provided and shall fulfill the same roles and responsibilities as the primary SSHO. The Alternate Safety Officer shall have the required training, experience, and qualifications in accordance with EM 385-1-1 Section 01.A.17, and all associated sub-paragraphs. When the SSHO is temporarily (not to exceed 8 hours) off-site, a Designated Representative (DR) from the Prime Contractors' staff, as identified in the AHA may be used in lieu of an Alternate Safety Officer and shall be on the project site, at all times, when work is being performed. Note that the DR is a collateral duty safety position, with safety duties in addition to their full-time occupation. Each subcontractor shall designate a minimum of one CP in compliance with 29 CFR 1926.20 (b)(2) that will be identified as a CP to administer their individual safety programs.

C. Further, all specialized Competent Persons for the work crews will be supplied by the respective contractor as required by 29 CFR 1926 (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).

D. 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

E. 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, and prior to the Kick-Off meeting, as part of the APP with the training documentation and/or AHA as listed in Section 1.8 below.

F. 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 Facility Safety Manager and 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.

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 a (minimum) weekly documented safety meeting. Submit records of these meetings to the Contracting Officer Representative as part of the requirements for daily reporting without fail.

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 Facility Safety Manager and 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 Facility Safety Manager and 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 Facility Safety Manager and 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 Facility Safety Manager and 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 Facility Safety Manager and 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 Facility Safety Manager and Contracting Officer Representative within 7 calendar days of the accident. The Facility Safety Manager and 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 Facility Safety Manager and 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 Facility Safety Manager and Contracting Officer Representative monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Facility Safety Manager and 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 Facility Safety Manager and 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 Facility Safety Manager and 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 Facility Safety Manager and 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

2. 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.

3. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose

4. Adhesive Walk-off Mats: Provide minimum size mats of 24 inches x 36 inches

5. Disinfectant: EPA-registered, Hospital-approved disinfectant or equivalent product

6. 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 Facility Safety Manager and 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 construction areas, or the areas that are described in phasing requirements, and adjoining areas. Construct partitions of gypsum board 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. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.

2. Install 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 Facility Safety Manager and Contracting Officer Representative.

H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Facility Safety Manager and 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.

K. Standpipes: Install and extend standpipes up with each floor in accordance with 29 CFR 1926 and NFPA 241. Do not charge wet standpipes subject to freezing until weather protected.

L. Sprinklers: Install, energize, 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 Facility Safety Manager and 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 Facility Safety Manager and 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 and Contracting Officer Representative. Obtain permits from Contracting Officer Representative at least 12 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 Facility Safety Manager and Contracting Officer Representative.

Q. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction, including rooftops. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.

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 Chief Engineer, as the Authority Having Jurisdiction (AHJ), with 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 Chief Engineer, Facility Safety Manager 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 Facility Safety Manager and Contracting Officer Representative 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.

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 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 and Contracting Officer Representative.

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.

1.22 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.

1.23 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 and Contracting Officer Representative.

1.24 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 and Contracting Officer Representative. Obtain permits from Facility Safety Manager and Contracting Officer Representative at least 5 business days in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

1.25 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.

1.26 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 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained by the General Contractor.

1.2 APPLICABLE PUBLICATIONS:

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

B. American Association of State Highway and Transportation Officials (AASHTO):

T27-11..... Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates

T96-02 (R2006)..... Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

T99-10..... Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop

T104-99 (R2007)..... Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

T180-10..... Standard Method of Test for Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop

T191-02(R2006)..... Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method

T310-13..... Standard Method of Test for In-place Density and Moisture Content of Soil and Soil-aggregate by Nuclear Methods (Shallow Depth)

C. American Concrete Institute (ACI):

506.4R-94 (R2004)..... Guide for the Evaluation of Shotcrete

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

A370-12..... Standard Test Methods and Definitions for Mechanical Testing of Steel Products

A416/A416M-10..... Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete

C31/C31M-10..... Standard Practice for Making and Curing Concrete Test Specimens in the Field
C33/C33M-11a..... Standard Specification for Concrete Aggregates
C39/C39M-12..... Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
C109/C109M-11b..... Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
C136-06..... Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
C138/C138M-10b..... Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
C140-12..... Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
C143/C143M-10a..... Standard Test Method for Slump of Hydraulic Cement Concrete
C172/C172M-10..... Standard Practice for Sampling Freshly Mixed Concrete
C173/C173M-10b..... Standard Test Method for Air Content of freshly Mixed Concrete by the Volumetric Method
C330/C330M-09..... Standard Specification for Lightweight Aggregates for Structural Concrete
C567/C567M-11..... Standard Test Method for Density Structural Lightweight Concrete
C780-11..... Standard Test Method for Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C1019-11..... Standard Test Method for Sampling and Testing Grout
C1064/C1064M-11..... Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete
C1077-11c..... Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
C1314-11a..... Standard Test Method for Compressive Strength of Masonry Prisms
D422-63(2007)..... Standard Test Method for Particle-Size Analysis of Soils
D698-07e1..... Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort

D1140-00(2006)..... Standard Test Methods for Amount of Material in Soils Finer than No. 200 Sieve

D1143/D1143M-07e1..... Standard Test Methods for Deep Foundations Under Static Axial Compressive Load

D1188-07e1..... Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples

D1556-07..... Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

D1557-09..... Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft lbf/ft3 (2,700 KNm/m3))

D2166-06..... Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

D2167-08)..... Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

D2216-10..... Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

D2974-07a..... Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

D3666-11..... Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

D3740-11..... Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as used in Engineering Design and Construction

D6938-10..... Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

E94-04(2010)..... Standard Guide for Radiographic Examination

E164-08..... Standard Practice for Contact Ultrasonic Testing of Weldments

E329-11c..... Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

E543-09..... Standard Specification for Agencies Performing Non-Destructive Testing

E605-93(R2011)..... Standard Test Methods for Thickness and Density of Sprayed Fire Resistive Material (SFRM) Applied to Structural Members

E709-08..... Standard Guide for Magnetic Particle Examination

E1155-96(R2008)..... Determining FF Floor Flatness and FL Floor Levelness Numbers

F3125/F3125M-15..... Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

E. American Welding Society (AWS):

D1.D1.1M-10..... Structural Welding Code-Steel

1.3 REQUIREMENTS:

A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E329, C1077, D3666, D3740, A880, E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."

B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by Resident Engineer. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of Resident Engineer to such failure.

C. Written Reports: Testing laboratory shall submit test reports to Resident Engineer, Contractor, unless other arrangements are agreed to in writing by the Resident Engineer. Submit reports of tests that fail to meet construction contract requirements on colored paper.

D. Verbal Reports: Give verbal notification to Resident Engineer immediately of any irregularity.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK: (NOT USED)

3.2 FOUNDATION PILES: (NOT USED)

3.3 FOUNDATION CAISSONS: (NOT USED)

3.4 LANDSCAPING: (NOT USED)

3.5 ASPHALT CONCRETE PAVING: (NOT USED)

3.6 SITE WORK CONCRETE: (NOT USED)

3.7 POST-TENSIONING OF CONCRETE: (NOT USED)

3.8 CONCRETE: (NOT USED)

3.9 REINFORCEMENT: (NOT USED)

3.10 SHOTCRETE: (NOT USED)

3.11 PRESTRESSED CONCRETE: (NOT USED)

3.12 ARCHITECTURAL PRECAST CONCRETE: (NOT USED)

3.13 MASONRY: (NOT USED)

3.14 STRUCTURAL STEEL:

A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Welding shall conform to AWS D1.1 Structural Welding Code.

B. Prefabrication Inspection:

1. Review design and shop detail drawings for size, length, type and location of all welds to be made.
2. Approve welding procedure qualifications either by pre-qualification or by witnessing qualifications tests.
3. Approve welder qualifications by certification or retesting.
4. Approve procedure for control of distortion and shrinkage stresses.
5. Approve procedures for welding in accordance with applicable sections of AWS D1.1.

C. Fabrication and Erection:

1. Weld Inspection:
   a. Inspect welding equipment for capacity, maintenance and working condition.
   b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
   c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
   d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.

e. Measure 25 percent of fillet welds.
f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
   1) 20 percent of all shear plate fillet welds at random, final pass only.
   2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
   3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
   4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
   5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.
g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.
h. Welding Radiographic Testing: Test in accordance with ASTM E94, and AWS D1.1 for 5 percent of all full penetration welds at random.
i. Verify that correction of rejected welds are made in accordance with AWS D1.1.
j. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.

2. Bolt Inspection:
   a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM F3125 Bolts.
   b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM F3125 Bolts. Inspect all bolts in connection when one or more are rejected.
   c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM F3125 Bolts. Inspect all bolts in connection when one or more are rejected.

d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.

e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.

f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.

D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to Resident Engineer.

3.15 STEEL DECKING: (NOT USED)

3.16 SHEAR CONNECTOR STUDS: (NOT USED)

3.17 SPRAYED-ON FIREPROOFING:

A. Provide field inspection and testing services to certify sprayed-on fireproofing has been applied in accordance with contract documents.

B. Obtain a copy of approved submittals from Resident Engineer.

C. Use approved installation in test areas as criteria for inspection of work.

D. Test sprayed-on fireproofing for thickness and density in accordance with ASTM E605.

1. Thickness gauge specified in ASTM E605 may be modified for pole extension so that overhead sprayed material can be reached from floor.

E. Location of test areas for field tests as follows:

1. Thickness: Select one bay per floor, or one bay for each 930 m^2 (10,000 square feet) of floor area, whichever provides for greater number of tests. Take thickness determinations from each of following locations: Metal deck, beam, and column.

2. Density: Take density determinations from each floor, or one test from each 930 m^2 (10,000 square feet) of floor area, whichever provides for greater number of tests, from each of the following areas: Underside of metal deck, beam flanges, and beam web.

F. Submit inspection reports, certification, and instances of noncompliance to Resident Engineer.

3.18 TYPE OF TEST:

Approximate Number of Tests Required

A. Structural Steel:

Ultrasonic Testing of Welds (ASTM E164) ___1_

Magnetic Particle Testing of Welds (ASTM E709) ___1_

Radiographic Testing of Welds (ASTM E94) ___1_

K. Sprayed-On Fireproofing:

Thickness and Density Tests (ASTM E605) ____1

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SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

B. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.

C. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:

1. Adversely effect human health or welfare,
2. Unfavorably alter ecological balances of importance to human life,
3. Effect other species of importance to humankind, or;
4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.

Definitions of Pollutants:

Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.

Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.

Sediment: Soil and other debris that has been eroded and transported by runoff water.

Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.

Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.

Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.

Sanitary Wastes:

Sewage: Domestic sanitary sewage and human and animal waste.

Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2 QUALITY CONTROL

Establish and maintain quality control for the environmental protection of all items set forth herein.

Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

1.3 REFERENCES

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

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

33 CFR 328..... Definitions

1.4 SUBMITTALS

In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the Contracting Officer’s Representative (COR) to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the Contracting Officer for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:

Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.

Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.

Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.

Description of the Contractor's environmental protection personnel training program.

A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.

Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.

Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.

Permits, licenses, and the location of the solid waste disposal area.

Drawings showing locations of any proposed temporary excavations or embankments for haul roads, material storage areas, structures, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan approved by the District Office of the U.S. Soil Conservation Service and the Department of Veterans Affairs.

Environmental Monitoring Plans for the job site including land, water, air, and noise.

Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.

Inclusion of “best management practices” and methodologies.

Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

1.5 PROTECTION OF ENVIRONMENTAL RESOURCES

Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.

Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and landforms without permission from the COR. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted. Provide erosion control plans, in phases where required.

Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.

Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.

Box and protect from damage existing trees and shrubs to remain on the construction site.

Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.

Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.

Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.

Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.

Sediment Basins: Trap sediment from construction areas in temporary or permanent sediment basins that accommodate the runoff of a local storm. After each storm, pump the basins dry and remove the accumulated sediment. Control overflow/drainage with paved weirs or by vertical overflow pipes, draining from the surface.

Reuse or conserve the collected topsoil sediment as directed by the COR. Topsoil use and requirements are specified in Section 31 20 00, EARTH MOVING.

Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.

Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation

control features. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.

Manage borrow areas on Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.

Manage and control spoil areas on Government property to limit spoil to areas on the Environmental Protection Plan and prevent erosion of soil or sediment from entering nearby water courses or lakes.

Protect adjacent areas from despoilment by temporary excavations and embankments.

Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.

Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.

Handle discarded materials other than those included in the solid waste category as directed by the COR.

Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.

Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.

Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.

Monitor water areas affected by construction.

Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.

Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of Illinois Title 35 and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.

Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.

Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.

Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.

Odors: Control odors of construction activities and prevent obnoxious odors from occurring.

Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the COR. Maintain noise-produced work at or below the decibel levels and within the time periods specified.

Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00 p.m unless otherwise permitted by local ordinance or the COR. Repetitive impact noise on the property shall not exceed the following dB limitations:

Time Duration of Impact Noise	Sound Level in dB
More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than three minutes of any hour	80
Less than 12 minutes of any hour	75

Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:

Maintain maximum permissible construction equipment noise levels at 15 meter (50 feet) (dBA):

EARTHMOVING		MATERIALS HANDLING	
FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
DOZERS	75	CRANES	75
TRACTORS	75	DERRICKS IMPACT	75
SCAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80
PUMPS	75	BLASTING	
GENERATORS	75	SAWS	75
COMPRESSORS	75	VIBRATORS	75

Use shields or other physical barriers to restrict noise transmission.

Provide soundproof housings or enclosures for noise-producing machinery.

Use efficient silencers on equipment air intakes.

Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.

Line hoppers and storage bins with sound deadening material.

Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.

Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being performed above 55 dB(A) noise level. Measure noise exposure at the property line or 15 m (50 feet) from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 900 to 1800 mm (three to six feet) in front of any building face. Submit the recorded information to the COR noting any problems and the alternatives for mitigating actions.

Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or

misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.

Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition satisfactory to the COR. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

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SECTION 01 58 16
TEMPORARY INTERIOR SIGNAGE

PART 1 GENERAL

1.1 DESCRIPTION

This section specifies temporary interior signs.

PART 2 PRODUCTS

2.1 TEMPORARY SIGNS

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

PART 3 EXECUTION

3.1 INSTALLATION

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

3.2 LOCATION

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

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SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.

B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.

C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:

1. Waste Management Plan development and implementation.
2. Techniques to minimize waste generation.
3. Sorting and separating of waste materials.
4. Salvage of existing materials and items for reuse or resale.
5. Recycling of materials that cannot be reused or sold.

D. At a minimum, the following waste categories shall be diverted from landfills:

1. Inert materials (e.g., concrete, masonry, and asphalt).
2. Clean dimensional wood and palette wood.
3. Metal products (e.g., steel, wire, beverage containers, copper, etc.).
4. Cardboard, paper, and packaging.
5. Plastics (e.g., ABS, PVC).
6. Carpet and/or pad.
7. Gypsum board.
8. Insulation.
9. Paint.
10. Fluorescent lamps.

1.2 RELATED WORK

A. Section 02 41 00, DEMOLITION.

B. Section 01 00 00, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction/Demolition waste includes products of the following:

1. Excess or unusable construction materials.
2. Packaging used for construction products.
3. Poor planning and/or layout.
4. Construction error.
5. Over ordering.
6. Weather damage.
7. Contamination.
8. Mishandling.
9. Breakage.

B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.

C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.

D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.

E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website http://www.wbdg.org/tools/cwm.php provides a Construction Waste Management Database that contains information on companies that haul,

collect, and process recyclable debris from construction projects.

F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.

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.

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 Resident Engineer a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
   1. Procedures to be used for debris management.
   2. Techniques to be used to minimize waste generation.
   3. Analysis of the estimated job site waste to be generated:
      a. List of each material and quantity to be salvaged, reused, recycled.
      b. List of each material and quantity proposed to be taken to a landfill.
   4. Detailed description of the Means/Methods to be used for material handling.
      a. On site: Material separation, storage, protection where applicable.
      b. Off site: Transportation means and destination. Include list of materials.
         1) Description of materials to be site-separated and self-hauled to designated facilities.
         2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
      c. The names and locations of mixed debris reuse and recycling facilities or sites.
      d. The names and locations of trash disposal landfill facilities or sites.
      e. Documentation that the facilities or sites are approved to receive the materials.

C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.

Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

1.6 APPLICABLE PUBLICATIONS

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

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

LEED Green Building Rating System for New Construction

1.7 RECORDS

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. List of each material and quantity to be salvaged, recycled, reused.

B. List of each material and quantity proposed to be taken to a landfill.

C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

PART 3 - EXECUTION

3.1 COLLECTION

A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.

B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.

C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

3.2 DISPOSAL

A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.

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 21 13
SITE SURVEYS

PART 1 - GENERAL

1.1 SUMMARY

1. Section Includes:
   1. Researching and collecting documents informing surveys.
   2. Performing utility surveys.
   3. Creating survey drawings.

1.2 APPLICABLE PUBLICATIONS

2. Comply with references to extent specified in this section.

1.3 SUBMITTALS

3. Survey Drawings, as described in section 3.4.

1.4 QUALITY ASSURANCE

4. Land Surveyor: One of the following:
   1. Professional Land Surveyor: One who possesses a valid state license as a "Professional Land Surveyor" from the state in which they practice, and where the project is located.
   2. Professional Civil Engineer: One who possesses a valid state license as a "Professional Civil Engineer" from the state in which they practice, and where the project is located. For this section, the term "land surveyor" shall also include Professional Civil Engineers authorized to practice Land Surveying under the laws of the state in which they practice.

PART 2 - PRODUCTS

2.1 ACCESSORIES

5. Monuments: Iron pin, with driven 16 mm (5/8 inch) diameter, minimum 600 mm (24 inches) long to prevent displacement.
6. Stakes: Hardwood.
7. Flagging: Plastic, roll form, highly visible, solid color.

PART 3 - EXECUTION

3.1 EXAMINATION

8. Research public and VA facility records for deeds, maps, monuments, plats, surveys, title certificates or abstracts, rights-of-way, easements, section line, other boundary line locations, and other documents pertaining to project site.
9. Research public and VA facility utility records for aerial, surface, and subgrade structures and utility service lines and easements.

3.2 PREPARATION

10. Coordinate with Contracting Officer's Representative for site access.

11. Coordinate with adjacent property owners when access to adjoining properties is required.

1. Notify Contracting Officer's Representative when access is denied.

3.3 SURVEYS

12. Utility Survey:

1. Locate piped utilities and utility structures. Identify service type, material, sizes, depths, and pressures. Establish inverts in and out on gravity sewer manholes. If depth is critical and manholes are not available identify depth with ground-penetrating radar (GPR).

2. Locate fire hydrants.

3. Locate wired utilities and utility structures. Identify service type, rated capacities, and elevations above and below grade.

4. Identify each utility authority including contact person and phone number.

3.4 SURVEY DRAWING REQUIREMENTS

13. Consult Contracting Officer's Representative to confirm required survey scale and drawing size.

1. Drawing Size to plot: Maximum 760 by 1070 mm (30 by 42 inches).

2. If the plat or map of survey consists of more than one sheet, the sheets shall be numbered, the total number of sheets indicated and the match lines be shown on each sheet.

3. Boundary Survey Scale: Maximum 1 to 35 (1 inch equals 30 feet).

4. Enlarged Detail Areas: Scale as required to present dimensional data and survey information clearly. Maintain orientation aligned with smaller scale view.

5. Plan Orientation: North at top of drawing sheet.

6. Unless specifically noted otherwise, develop electronic drawings files of the survey in accordance with the VA BIM Standard as required by PG-18-15 (https://www.cfm.va.gov/til/aeDesSubReq.asp) and VA's BIM Manual (https://www.cfm.va.gov/til/projReq.asp) (refer to section 2.3 BIM Technology and Platforms for CAD/BIM software). Verify software version with VA Project Manager / VA CAD/BIM Standards Manager.

7. Electronic files must be in accordance with the VA BIM Standard as required by PG-18-15 (https://www.cfm.va.gov/til/aeDesSubReq.asp) and VA's BIM Manual (https://www.cfm.va.gov/til/projReq.asp).

8. Electronic drawings files must be submitted in their native authoring software (AUTOCAD .dwg, AutoCAD Civil 3D, REVIT. rvt, etc. formats), and in PDF format.

9. Provide a photographic record (in digital formats) of relevant or key features of the surveyed land.

10. Provide all field raw data files, field notes, field survey points, raw aerial mapping CAD files, LiDAR point clouds, photogrammetric drone image files, and all ground control data used for any remote (aerial, LiDAR, drone) mapping methods.

14. Drawing Notations:

1. Provide notes that the two installed monuments tied to the State Plane Coordinate system are the basis for the coordinate system indicated on the CADD survey drawings.

2. Land Surveyor: Name, address, telephone number, signature, seal, and registration number.

3. Survey Dates: Date survey was initially completed and subsequent revision dates.

4. Certification: Certify each drawing adjacent to land surveyor's seal:

5. "I hereby certify that all information indicated on this drawing was obtained or verified by actual measurements in the field and that every effort has been made to provide complete and accurate information."

6. Title, number, and total number of drawings on each drawing.

7. Scale in metric and imperial measurement.

8. Graphic scale in metric and imperial measurement.

9. Graphic symbol and abbreviation legends.

10. North arrow for plan view drawings.

11. Benchmark locations.

12. Horizontal and vertical control datum.

13. Adjacent property owner names.

14. Zoning classifications.

15. Building street numbers.

16. Evidence of Possession: Indicate character and location of evidence of possession affecting project site. Notation absence signifies no observable evidence of possession.

15. Vicinity Map: Indicate project site and nearby roadways and intersections.

16. Record Documents Forming Survey Basis: Indicate titles, source, and recording data of documents relied upon to complete survey.

17. Legal Description: Recorded title boundaries.

18. Public and Private Utilities:

1. Indicate information source and operating authority for each utility.

2. Indicate utilities existing on or serving project site.

3. Indicate fire hydrants on project site and within 150 m (500 feet) of survey boundary.

4. Indicate manholes, catch basins, inlets, vaults, and other surface indications of subgrade services.

5. Indicate depths or invert elevations, sizes, materials, and pressures of utility pipes.

6. Indicate wires and cables serving, crossing, and adjacent to project site.

7. Indicate exterior lighting, traffic control facilities, security, and communications systems.

8. Indicate utility poles on project site and within 3 m (10 feet) of survey boundary.

9. Indicate dimensions of cross-wires or overhangs affecting project site.

19. Trees:

1. Indicate individual trees with minimum 150 mm (6 inches) diameter measured at 1200 mm (48 inches) above grade.

2. Indicate wooded area perimeter outline and description of predominant vegetation.

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SECTION 02 41 00
DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION:

A. 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. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 00, EARTH MOVING

B. Safety Requirements: Section 01 35 26 Safety Requirements Article, ACCIDENT PREVENTION PLAN (APP).

C. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

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

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 fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

D. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.

E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.

F. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

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

1.4 UTILITY SERVICES:

A. Demolish and remove outside utility service lines shown to be removed.

B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

PART 2 - EXECUTION

2.1 DEMOLITION:

A. Completely demolish and remove buildings and structures, including all appurtenances related or connected thereto, as noted below:

1. 1.As required for installation of new utility service lines.
2. 2.To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.

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 Resident Engineer. 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.

C. In removing buildings and structures of more than two stories, demolish work story by story starting at highest level and progressing down to third floor level. Demolition of first and second stories may proceed simultaneously.

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 1500mm (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 1500 mm (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.

2.2 CLEAN-UP:

A. 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 07 81 00
APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies spray-applied mineral fiber and cementitious coverings to provide fire resistance to interior structural steel members shown.

1 1.3 SUBMITTALS:

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

C. Installer qualifications.

D. Testing laboratory accreditations.

E. Manufacturer's Literature and Data:

1. Manufacturer's complete and detailed application instructions and specifications.
2. Manufacturer's repair and patching instructions.

F. Certificates:

1. Certificate from testing laboratory attesting fireproofing material and application method meet the specified fire ratings.
   a. List thickness and density of material required to meet fire ratings.
   b. Accompanied by complete test report and test record.
2. Manufacturer's certificate indicating sprayed-on fireproofing material supplied under the Contract is same within manufacturing tolerance as fireproofing material tested.

G. Miscellaneous:

1. Manufacturer's written approval of surfaces to receive sprayed-on fireproofing.
2. Manufacturer's written approval of completed installation.
3. Manufacturer's written approval of the applicators of fireproofing material.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver to jobsite in sealed containers marked and labeled to show manufacturer's name and brand and UL certification markings of compliance with the specified requirements.

B. Remove damaged or opened containers from the site.

C. Store the materials off the ground, under cover, away from damp surfaces.

D. Keep dry until ready for use.

E. Remove materials that have been exposed to water before installation from the site.

1.4 FIELD CONDITIONS:

A. Temperature: Do not apply fireproofing when substrate or ambient temperature is below 4 degrees C (40 degrees F) unless temporary protection and heat are provided to maintain temperature at or above stated value during application and for 24 hours before and after application.

B. Humidity: Maintain relative humidity levels within limits recommended by fireproofing manufacturer.

C. Ventilation: Provide ventilation to properly dry the fireproofing after application. Provide a minimum of four (4) air exchanges per hour by forced air circulation. When permitted by Contracting Officer Representative (COR), ventilate by natural circulation.

1.5 QUALITY ASSURANCE:

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer’s products according to specified requirements. Submit manufacturer’s certification that each installer is trained and qualified to install the specified fireproofing. Submit evidence that each installer has a minimum of three (3) years’ experience and a minimum of four (4) installations using the specified fireproofing.

B. Testing Laboratory Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority. Submit a copy of the Certificate of Accreditation and Scope of Accreditation.

C. Test for fire endurance in accordance with ASTM E119, for fire rating specified, in a nationally recognized laboratory.

D. Manufacturer's inspection and approval of surfaces to receive fireproofing.

E. Manufacturer's approval of fireproofing applications.

F. Manufacturer's approval of completed installation.

G. Manufacturer's representative is to observe and advise at the commencement of application and is required to visit the site as

required thereafter for the purpose of ascertaining proper application.

H. Pre-Application Test Area.

1. Apply a test area consisting of a typical overhead fireproofing installation, including not less than 4.5 m (15 feet) of beam and deck.
   a. Apply to one (1) column.
   b. Apply for the hourly ratings required in the construction documents.
2. Install in location selected by the COR, for approval by the representative of the fireproofing material manufacturer and the COR.
3. Perform Bond test for cohesive and adhesive strength in accordance with ASTM E736 for each applied fireproofing design used.
4. Perform density test in accordance with ASTM E736 for each applied fireproofing design used.
5. Do not proceed in other areas until installation of test area has been completed and approved.
6. Keep approved installation area open for observation as criteria for sprayed-on fireproofing.

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):

E84-14.....Surface Burning Characteristics of Building Materials

E119-12a.....Fire Tests of Building Construction and Materials

G21-13.....Determining Resistance of Synthetic Polymeric Materials to Fungi

C. Underwriters Laboratories, Inc. (UL):

Fire Resistance Directory...Latest Edition including Supplements

D. Warnock Hersey (WH):

Certification Listings. Latest Edition

E. Factory Mutual System (FM):

Approval Guide.....Latest Edition including Supplements

F. Environmental Protection Agency (EPA):

40 CFR 59(2014).....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

2 PART 2 - PRODUCTS

2.1 SPRAYED-ON FIREPROOFING:

A. ASTM E1042, Class (a), Category A.

1. Type I, factory mixed cementitious materials with approved aggregate.
2. Type II, factory mixed mineral fiber with integral inorganic binders minimum 240 kg per cubic meter (15 lb. per cubic feet) density per ASTM E605 test unless specified otherwise. Use in areas that are completely encased.

B. Materials containing asbestos are not permitted.

C. Fireproofing characteristics when applied in the thickness and density required to achieve the fire-rating specified.

	Characteristic	Test	Results
1.	Deflection	ASTM E759	No cracking, spalling, or delamination when backing to which it is applied has a deflection up to 1/120 in 3 m (10 ft.)
2.	Corrosion-Resistance	ASTM E937	No promotion of corrosion of steel.
3.	Bond Impact	ASTM E760	No cracking, spalling, or delamination.
4.	Cohesion/Adhesion (Bond Strength)	ASTM E736	Minimum cohesive/adhesive strength of 9.57 kPa (200 lbf per sq. ft.) for protected areas. 19.15 kPa (400 lbf per sq. ft.) for exposed areas.
5.	Air Erosion	ASTM E859	Maximum gain weight of the collecting filter 0.27 gm per sq. meter (0.025 gm per sq. ft.).
6.	Compressive Strength	ASTM E761	Minimum compressive strength 48 kPa (1000 psf).
7.	Surface Burning Characteristics with adhesive and sealer to be used	ASTM E84	Flame spread 25 or less smoke developed 50 or less
8.	Fungi Resistance	ASTM G21	Resistance to mold growth when inoculated with aspergillus niger (28 days for general application)

2.2 ADHESIVE:

A. Bonding adhesive for Type II (fibrous) materials as recommended and supplied by the fireproofing material manufacturer.

B. Adhesive may be an integral part of the material or applied separately to surface receiving fireproofing material.

2.3 SEALER:

A. Sealer for Type II (fibrous) material as recommended and supplied by the fireproofing material manufacturer.

B. Surface burning characteristics as specified for fireproofing material.

C. Fungus resistant.

D. Sealer may be an integral part of the material or applied separately to the exposed surface. When applied separately use contrasting color pigmented sealer, white preferred.

2.4 WATER:

A. Clean, fresh, and free from organic and mineral impurities.

B. pH of 6.9 to 7.1.

2.5 MECHANICAL BOND MATERIAL:

A. Expanded Metal Lath: ASTM C847, minimum weight of 0.92 kg per square meter (1.7 pounds per square yard) or as required, according to fire- resistance designs indicated and fire proofing manufacturer's written instructions.
B. Fasteners: ASTM C841.
C. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.
D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachments.

3 PART 3 - EXECUTION

3.1 EXAMINATION:

A. Verify surfaces to receive fireproofing are clean and free of dust, soot, oil, grease, water soluble materials or any foreign substance which would prevent adhesion of the fireproofing material.
B. Verify hangers, inserts and clips are installed before the application of fireproofing material.
C. Verify ductwork, piping, and other obstructing material and equipment is not installed that will interfere with fireproofing installation.
D. Verify concrete work on steel decking and concrete encased steel is completed.
E. When applied in conjunction with roof structures or roof decks, verify that roofing, installation of rooftop HVAC equipment, and other related work are complete.
F. Verify temperature and enclosure conditions required by fire-proofing material manufacturer.
G. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond. Submit test report.

3.2 APPLICATION:

A. Do not start application until written approval has been obtained from manufacturer of fireproofing materials that surfaces have been inspected by the manufacturer or his representative and are suitable to receive sprayed-on fireproofing.

B. Coordinate application of fireproofing material with other trades.

C. Cover other work and exterior openings subject to damage from fallout or overspray of fireproofing materials during application.

D. Application of Metal Lath:

1. Apply to beam and columns having painted surfaces which fail ASTM E736 Bond Test requirements in pre-application test area.
2. Apply to beam flanges 305 mm (12-inches) or more in width.
3. Apply to column flanges 406 mm (16-inches) or more in width.
4. Apply to beam or column web 406 mm (16-inches) or more in depth.
5. Tack weld or mechanically fasten on maximum of 305 mm (12-inch) center.
6. Lap and tie lath member in accordance with ASTM C841.

E. Mix and apply in accordance with manufacturer's instructions.

1. Mechanically control material and water ratios.
2. Apply adhesive and sealer, when not an integral part of the materials, in accordance with the manufacturer's instructions.
3. Apply to density and thickness indicated in UL Fire Resistance Directory, FM Approval Guide, or WH Certification Listings unless specified otherwise. Test in accordance with ASTM E119.Minimum ASTM E605 applied dry density per cubic meter (cubic foot) for the underside of the walk on deck (interstitial) hung purlin or beam and steel deck, columns in interstitial spaces and mechanical equipment rooms to be as follows:

F. Complete application is to be completed in one area. Inspection and approval by COR is required before removal of application equipment and proceeding with further work.

3.3 FIELD TESTS:

A. The applied fireproofing to be tested by a COR approved independent testing laboratory and paid for by the Contractor. Submit test

reports documenting results of tests on the applied material in the project.

B. COR will select area to be tested in specific bays on each floor using a geometric grid pattern. Apply test sample every 929 square meters (10,000 square feet) of floor area or two (2) for each floor, whichever produces the greatest number of test areas.

C. Test for thickness and density in accordance with ASTM E605. Areas showing thickness less than that required as a result of fire endurance test are not acceptable.

D. Areas showing less than required fireproofing characteristics are not suitable for the following field tests.

1. Test for cohesion/adhesion: ASTM E736.

2. Test for bond impact strength: ASTM E760.

3.4 PATCHING AND REPAIRING:

A. Inspect after mechanical, electrical and other trades have completed work in contact with fireproofing material, but before sprayed material is covered by subsequent construction.

B. Perform corrective measures in accordance with fireproofing material manufacturer's recommendations.

1. Respray areas requiring additional fireproofing material to provide the required thickness and replace dislodged or removed material.

2. Spray material for patching by machine directly on point to be patched, or into a container and then hand apply.

3. Do not hand mix material.

C. Repair:

1. Respray test and rejected areas.

2. Patch fireproofing material which is removed or disturbed after approval.

D. Perform final inspection of sprayed areas after patching and repair.

4 3.6 SCHEDULE:

A. Apply fireproofing material in interior structural steel members and on underside of interior steel floor and roof decks, except on following surfaces:

1. Structural steel and underside of steel decks in elevator or dumbwaiter machine rooms.

2. Steel members in elevator hoist ways.

3. Areas used as air handling plenums.

4. Steel to be encased in concrete or designated to receive other type of fireproofing.

Fire Rating Schedule			
Type	Element	Hourly Rating	UL Design Reference
	Floor supports	2	NA

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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. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

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

1.3 SUBMITTALS:

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

B. Sustainable Design Submittals, as described below:

1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Installer qualifications.

D. Inspector qualifications.

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

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

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

H. 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):

E84-14.....Surface Burning Characteristics of Building Materials

E699-09.....Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components

E814-13a.....Fire Tests of Through-Penetration Fire Stops E2174-14.....Standard Practice for On-Site Inspection of Installed Firestops

E2393-10a.....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 Annual Issue Fire Resistance Directory

723-10(2008).....Standard for Test for Surface Burning Characteristics of Building Materials

1479-04(R2014).....Fire Tests of Through-Penetration Firestops

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

F. 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 101 mm (4 in.) nominal pipe or 0.01 sq. m (16 sq. in.) 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. Release no dangerous or flammable out gassing during the drying or curing of products.
3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
4. When installed in exposed areas, capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
5. 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 101 mm (4 in.) 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 150 mm (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 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 GENERAL

A. All hardware shall comply with ABAAS, (Architectural Barriers Act Accessibility Standard) unless specified otherwise.

B. Provide rated door hardware assemblies where required by most current version of the International Building Code (IBC).

C. Hardware for application on metal and wood doors and frames shall be made to standard templates. Furnish templates to the fabricator of these items in sufficient time so as not to delay the construction.

D. The following items shall be of the same manufacturer, except as otherwise specified:

1. Mortise locksets.

1.3 WARRANTY

F. Automatic door operators shall be subject to the terms of FAR Clause 52.246-21, except that the Warranty period shall be two years in lieu of one year for all items except as noted below:

Locks, latchsets, and panic hardware: 5 years.

Door closers and continuous hinges: 10 years.

1.4 MAINTENANCE MANUALS

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

1.5 SUBMITTALS

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

B. Samples and Manufacturers' Literature:

Samples: All hardware items (proposed for the project) that have not been previously approved by Builders Hardware Manufacturers Association shall be submitted for approval. Tag and mark all items with manufacturer's name, catalog number and project number.

Samples are not required for hardware listed in the specifications by manufacturer's catalog number, if the contractor proposes to use the manufacturer's product specified.

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

1.6 DELIVERY AND MARKING

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

1.7 INSTRUCTIONS

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

B. Provide removable core cylinders that are removable only with a special key or tool without disassembly of knob or lockset. Cylinders shall be BEST 7 pin type. Keying information shall be furnished at a later date by the COR.

1.8 APPLICABLE PUBLICATIONS

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

A156.5-14..... Cylinders and Input Devices for Locks.
A156.12-05 .....Interconnected Locks and Latches
A156.13-05..... Mortise Locks and Latches Series 1000
A156.14-07 .....Sliding and Folding Door Hardware
A156.16-08..... Auxiliary Hardware
A156.18-06..... Materials and Finishes
A156.20-06 .....Strap and Tee Hinges, and Hasps
A156.28-07 .....Master Keying Systems
A156.30-03 .....High Security Cylinders

B. Underwriters Laboratories, Inc. (UL):

Building Materials Directory (2008)

C. Architectural Barriers Act Accessibility Standards (ABAAS)

PART 2 - PRODUCTS

2.1 LOCKS AND LATCHES

A. Conform to ANSI A156.2. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall have not less than seven pins. Cylinders for all locksets shall be removable core type. Cylinders shall be furnished with construction removable cores and construction master keys. Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. All locksets or latches on double doors with fire label shall have latch bolt with 19 mm (3/4 inch) throw, unless shorter throw allowed by the door manufacturer’s fire label. Provide temporary keying device or construction core to allow opening and closing during construction and prior to the installation of final cores.

2.2 FINISHES

A. Exposed surfaces of hardware shall have ANSI a156.18, finishes as specified below. Finishes on all hinges, pivots, closers, thresholds, etc., shall be as specified below under "miscellaneous finishes."

B. Miscellaneous Finishes:

Hinges --exterior doors: 626 or 630.

Hinges --interior doors: 652 or 630.

Pivots: Match door trim.

Door Closers: Factory applied paint finish. Dull or Satin Aluminum color.

Thresholds: Mill finish aluminum.

Cover plates for floor hinges and pivots: 630.

Other primed steel hardware: 600.

PART 3 - EXECUTION

1.8 HARDWARE HEIGHTS

A. Hardware Heights from Finished Floor:

1. Locksets and latch sets centerline of strike 1024 mm (40-5/16 inches).

1.9 DEMONSTARTION

A. Demonstrate efficacy of mechanical hardware and electrical, and electronic hardware systems, including adjustment and maintenance procedures, to satisfaction of Resident/Project Engineer and VA Locksmith.

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SECTION 26 05 11
REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section applies to all sections of Division 26.

B. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, conductors and cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on the drawings.

C. 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.

D. Conductor ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited.

1.2 MINIMUM REQUIREMENTS

A. The 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, provided 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. Manufacture
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 a minimum of thirty (30) days prior to the manufacturer’s performing of the factory tests.
2. When factory tests are successful, contractor shall furnish four (4)

copies of the equipment manufacturer's certified test reports to the COR fourteen (14) days prior to shipment of the equipment, and not more than ninety (90) days after completion of the factory tests.

3. When factory tests are not successful, factory tests shall be repeated in the factory by the equipment manufacturer and witnessed by the Contractor. The Contractor shall be liable for all additional expenses for the Government to witness factory re- testing.

1.7 VARIATIONS FROM CONTRACT REQUIREMENTS

A. Where the Government or the Contractor requests variations from the contract requirements, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.8 MATERIALS AND EQUIPMENT PROTECTION

A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.

1. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
2. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
3. D amaged equipment shall be repaired or replaced, as determined by the COR.
4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
5. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.9 WORK PERFORMANCE

A. All electrical work shall comply with requirements of the latest NFPA 70 (NEC), NFPA 70B, NFPA 70E, NFPA 99, NFPA 110, 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, 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, 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, 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.

"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.

1.11EQUIPMENT INSTALLATION AND REQUIREMENTS

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 black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.

C. Install adhesive arc flash warning labels on all equipment as required by 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 in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. The Government's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.

C. All submittals shall include six copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Government to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

1. Mark the submittals, "SUBMITTED UNDER SECTION_____".

2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
3. Submit each section separately.

E. The submittals shall include the following:

1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.
2. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
3. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.

F. Maintenance and Operation Manuals:

1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.

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. 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.

The manuals shall include:

a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
b. A control sequence describing start-up, operation, and shutdown.
c. Description of the function of each principal item of equipment.
d. Installation instructions.
e. Safety precautions for operation and maintenance.
f. Diagrams and illustrations.
g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
h. Performance data.
i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall

indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.

j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.

H. After approval and prior to installation, furnish the COR with one sample of each of the following:

2. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.

Each type of conduit coupling, bushing, and termination fitting.

Conduit hangers, clamps, and supports.

Duct sealing compound.

Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

1.13 SINGULAR NUMBER

A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.14 ACCEPTANCE CHECKS AND TESTS

A. The Contractor shall furnish the instruments, materials, and labor for tests.

B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer’s representatives and technicians so that a complete, functional, and operational system is delivered to the Government.

C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment and repeat the tests 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 so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer for the Government.

1.16 INSTRUCTION

A. Instruction to designated Government personnel shall be provided for the particular equipment or system as required in each associated technical specification section.

B. 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 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.

E. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Installation of conductors and cables in manholes and ducts.

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:

Shop Drawings:

Submit sufficient information to demonstrate compliance with drawings and specifications.

Submit the following data for approval:

1) Electrical ratings and insulation type for each conductor and cable.

2) Splicing materials and pulling lubricant.

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:

No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.

No. 8 AWG and larger: Stranded.

No. 10 AWG and smaller: Solid; except shall be stranded for final connection to motors, transformers, and vibrating equipment.

Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

D. Conductor Color Code:

1. No. 10 AWG and smaller: Solid color insulation or solid color coating.

No. 8 AWG and larger: Color-coded using one of the following methods:

a. Solid color insulation or solid color coating.

b. Stripes, bands, or hash marks of color specified.

c. Color using 19 mm (0.75 inches) wide tape.

For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.

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.		

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.

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:

Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.

The integral insulator shall have a skirt to completely cover the stripped conductors.

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.

D. Above Ground Splices for 250 kcmil and Larger:
   1. Long barrel "butt-splice" or "sleeve" type compression connectors, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
   2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
   3. Splice and insulation shall be product of the same manufacturer.

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.

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.

1.5 WIRE LUBRICATING COMPOUND

A. A. Lubricating compound shall be suitable for the wire insulation and conduit and shall not harden or become adhesive.

B. 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. Splice conductors only in outlet boxes, junction boxes, pull boxes, manholes, or handholes.
D. Conductors of different systems (e.g., 120 V and 277 V) shall not be installed in the same raceway.
E. 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.
F. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic "zip" ties.
G. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.
H. Use expanding foam or non-hardening duct-seal to seal conduits entering a building, after installation of conductors.
I. Conductor Pulling:
    1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
    2. Use nonmetallic pull ropes.
    3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.
    4. All conductors in a single conduit shall be pulled simultaneously.
    5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
J. Number of conductors for branch circuits shall not exceed more than three branch circuits in any one conduit.
K. When stripping stranded conductors, use a tool that does not damage the conductor or remove conductor strands.

3.2 INSTALLATION IN MANHOLES (NOT USED)

3.3 PLICE AND TERMINATION INSTALLATION

A. Splices and terminations shall be mechanically and electrically secure and tightened to manufacturer's published torque values using a torque screwdriver or wrench.

B. Where the Government determines that unsatisfactory splices or terminations have been installed, replace the splices or terminations at no additional cost to the Government.

3.4 CONDUCTOR IDENTIFICATION

A. . When using colored tape to identify phase, neutral, and ground conductors larger than No. 8 AWG, apply tape in half-overlapping turns for a minimum of 75 mm (3 inches) from terminal points, and in junction boxes, pull boxes, and manholes. 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.

3.5 FEEDER CONDUCTOR IDENTIFICATION

A. In each interior pull box and each underground manhole and handhole, install brass tags on all feeder conductors to clearly designate their circuit identification and voltage. The tags shall be the embossed type, 40 mm (1-1/2 inches) in diameter and 40 mils thick. Attach tags with plastic ties.

3.6 EXISTING CONDUCTORS

A. Unless specifically indicated on the plans, existing conductors shall not be reused.

3.7 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.

3.8 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.

D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

3.9 DIRECT BURIAL CABLE INSTALLATION (NOT USED)

3.10 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.

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.

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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.

D. Section 26 12 19, PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS: pad-mounted, liquid-filled, medium-voltage transformers.

E. Section 26 13 13, MEDIUM-VOLTAGE CIRCUIT BREAKER SWITCHGEAR: Medium-voltage circuit breaker switchgear.

F. Section 26 23 13, GENERATOR PARALLELING CONTROLS: Generator paralleling controls.

G. Section 26 13 16, MEDIUM-VOLTAGE FUSIBLE INTERRUPTER SWITCHES: Medium-voltage fusible interrupter switches.

H. Section 26 22 00, LOW-VOLTAGE TRANSFORMERS: Low-voltage transformers.

I. Section 26 23 00, LOW-VOLTAGE SWITCHGEAR: Low-voltage switchgear.

J. Section 26 24 13, DISTRIBUTION SWITCHBOARDS: Low-voltage distribution switchboards.

K. Section 26 24 16, PANELBOARDS: Low-voltage panelboards.

L. Section 26 24 19, MOTOR CONTROL CENTERS: Motor control centers.

M. Section 26 32 13, ENGINE GENERATORS: Engine generators.

N. Section 26 36 23, AUTOMATIC TRANSFER SWITCHES: Automatic transfer switches.

O. Section 26 41 00, FACILITY LIGHTNING PROTECTION: Lightning protection.

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:

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.

Test Reports:

C. Two weeks prior to the final inspection, submit ground resistance field test reports to the Resident Engineer.

Certifications:

D. 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

467-13…… Thermoplastic-Insulated Wires and Cables

467-13 ..... Grounding and Bonding Equipment.

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 RODS (NOT USED)

2.3 CONCRETE ENCASED ELECTRODE (NOT USED)

2.4 GROUND CONNECTIONS (NOT USED)

2.5 EQUIPMENT RACK AND CABINET GROUND BARS (NOT USED)

2.6 GROUND TERMINAL BLOCKS

A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.7 GROUNDING BUS BAR

A. Pre-drilled rectangular copper bar with stand-off insulators, minimum 6.3 mm (0.25 inch) thick x 100 mm (4 inches) high in cross-section, length as shown on the drawings, with hole size, quantity, and spacing per detail shown on the drawings. Provide insulators and mounting brackets.

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 INACCESSIBLE GROUNDING CONNECTIONS (NOT USED)

3.3 MEDIUM-VOLTAGE EQUIPMENT AND CIRCUITS (NOT USED)

3.4 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS

A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

B. Metallic Piping, Building Structural Steel, and Supplemental Electrode(s):

1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water pipe systems, building structural steel, and supplemental or made electrodes. Provide jumpers across insulating joints in the metallic piping.
2. Provide a supplemental ground electrode as shown on the drawings and bond to the grounding electrode system.

C. Switchgear, Switchboards, Unit Substations, Panelboards, Motor Control Centers, Engine-Generators, Automatic Transfer Switches, and other electrical equipment:

1. Connect the equipment grounding conductors to the ground bus.
2. Connect metallic conduits by grounding bushings and equipment grounding conductor to the equipment ground bus.

D. Transformers:

1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the nearest component of the grounding electrode system.

3.5 RACEWAY

A. Conduit Systems:

Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.

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.

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.

Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a equipment grounding conductor to the equipment ground bus.

A. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and all branch circuits.

B. Boxes, Cabinets, Enclosures, and Panelboards:

Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).

Provide lugs in each box and enclosure for equipment grounding conductor termination.

C. Wireway Systems:

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.

Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).

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.

Use insulated No. 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 M (49 feet).

D. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.

F. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

G. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

H. Raised Floors: Provide bonding for all raised floor components as shown on the drawings.

I. Panelboard Bonding in Patient Care Areas: The equipment grounding terminal buses of the normal and essential branch circuit panel boards serving the same individual patient vicinity shall be bonded together with an insulated continuous copper conductor not less than No. 10 AWG, installed in rigid metal conduit.

3.6 OUTDOOR METALLIC FENCES AROUND ELECTRICAL EQUIPMENT (NOT USED)

3.7 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.

3.8 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

B. In operating rooms and at intensive care and coronary care type beds, bond the medical gas piping and medical vacuum piping at the outlets directly to the patient ground bus.

3.9 LIGHTNING PROTECTION SYSTEM (NOT USED)

3.10MAIN ELECTRICAL ROOM GROUNDING (NOT USED)

3.11EXTERIOR LIGHT POLES (NOT USED)

3.12GROUND RESISTANCE (NOT USED)

3.13GROUND ROD INSTALLATION (NOT USED)

3.14ACCEPTANCE 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.

C. Below-grade connections shall be visually inspected by the COR prior to backfilling. The Contractor shall notify the COR24 hours before the connections are ready for inspection.

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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 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire rated construction.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section 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.

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 raceway, 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 13 mm (0.5-inch) unless otherwise shown. Where permitted by the NEC, 13 mm (0.5-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 13 mm (0.5- inch).
2. Rigid Steel Conduit (RMC): Shall conform to UL 6 and NEMA C80.1.
3. Rigid Intermediate Steel Conduit (IMC): Shall conform to UL 1242 and NEMA C80.6.
4. Electrical Metallic Tubing (EMT): Shall conform to UL 797 and NEMA C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 V or less.
5. Flexible Metal Conduit: Shall conform to UL 1.
6. Liquid-tight Flexible Metal Conduit: Shall conform to UL 360.
7. Direct Burial Plastic Conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high-density polyethylene (PE).
8. Surface Metal Raceway: Shall conform to UL 5.

C. **Conduit Fittings:**

1. Rigid Steel and Intermediate Metallic Conduit Fittings:
   a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
   b. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
   c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
   d. Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
   e. Erickson (Union Type) and Set Screw Type Couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit

is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.

f. Sealing Fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.

2. Rigid Aluminum Conduit Fittings (NOT USED)
3. 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. Compression Couplings and Connectors: Concrete-tight and rain-tight, with connectors having insulated throats.
   d. Indent-type connectors or couplings are prohibited.
   e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
4. Flexible Metal Conduit Fittings:
   a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
   b. Clamp-type, with insulated throat.
5. Liquid tight Flexible Metal Conduit Fittings:
   a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
   b. Only steel or malleable iron materials are acceptable.
   c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
6. Direct Burial Plastic Conduit Fittings: Fittings shall meet the requirements of UL 514C and NEMA TC3.
7. Surface Metal Raceway Fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.
8. Expansion and Deflection Couplings:
   a. Conform to UL 467 and UL 514B.
   b. Accommodate a 19 mm (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 38 mm x 38 mm (1.5 x 1.5 inches), 12-gauge steel, cold-formed, lipped channels; with not less than 9 mm (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 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 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 2.4 M (8 feet) on centers with specified materials and as shown on drawings.
7. Do not use suspended ceilings, suspended ceiling supporting members, lighting fixtures, other conduits, cable tray, boxes, piping, or ducts to support conduits and conduit runs.
8. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.
9. Close ends of empty conduits with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
10. Conduit installations under fume and vent hoods are prohibited.
11. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid steel and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
12. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
13. Conduit bodies shall only be used for changes in direction and shall not contain splices.
14. Do not use aluminum conduits in wet locations.

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 COR.

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:

1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only:
   a. Where shown on the structural drawings.
   b. As approved by the COR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
   a. Conduit outside diameter larger than one-third of the slab thickness is prohibited.
   b. Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.
   c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (0.75-inch) of concrete around the conduits.
5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground continuity through the conduits. Tightening setscrews with pliers is prohibited.

B. Above Furred or Suspended Ceilings and in Walls:

1. Conduit for Conductors Above 600 V: Rigid steel. Mixing different types of conduits in the same system is prohibited.
2. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits in the same system is prohibited.
3. Align and run conduit parallel or perpendicular to the building lines.
4. Connect recessed lighting fixtures to conduit runs with maximum 1.8 M (6 feet) of flexible metal conduit extending from a junction box to the fixture.
5. Tightening set screws with pliers is prohibited.

6. For conduits running through metal studs, limit field cut holes to no more than 70% of web depth. Spacing between holes shall be at least 457 mm (18 inches). Cuts or notches in flanges or return lips shall not be permitted.

3.4 EXPOSED WORK INSTALLATION

A. Unless otherwise indicated on drawings, exposed conduit is only permitted in mechanical and electrical rooms.

B. Conduit for Conductors Above 600 V: Rigid steel. Mixing different types of conduits in the system is prohibited.

C. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. 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 2.4 M (8 feet) intervals.

G. Surface Metal Raceways: Use only where shown on drawings.

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 50 mm (2 inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6 M (20 feet) intervals in between.

3.5 DIRECT BURIAL INSTALLATION (NOT USED)

3.6 HAZARDOUS LOCATIONS

A. Use rigid steel conduit only.

B. Install UL approved sealing fittings that prevent passage of explosive vapors in hazardous areas equipped with explosion-proof lighting fixtures, switches, and receptacles, as required by the NEC.

3.7 WET OR DAMP LOCATIONS

A. Use rigid steel or IMC conduits unless as shown on drawings.

B. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.

C. Use rigid steel or IMC conduit within 1.5 M (5 feet) of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers, unless as shown on drawings. Conduit shall be half- lapped with 10

mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.

D. Conduits run on roof shall be supported with integral galvanized lipped steel channel, attached to UV-inhibited polycarbonate or polypropylene blocks every 2.4 M (8 feet) with 9 mm (3/8-inch) galvanized threaded rods, square washer and locknut. Conduits shall be attached to steel channel with conduit clamps.

3.8 MOTORS AND VIBRATING EQUIPMENT (NOT USED)

3.9 EXPANSION JOINTS

A. Conduits 75 mm (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 75 mm (3 inch) with junction boxes on both sides of the expansion joint. Connect flexible metal conduits to junction boxes with sufficient slack to produce a 125 mm (5 inch) vertical drop midway between the ends of the flexible metal conduit. Flexible metal conduit shall have a green insulated copper bonding jumper installed. In lieu of this flexible metal conduit, expansion and deflection couplings as specified above are acceptable.

C. Install expansion and deflection couplings where shown.

3.10 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 90 kg (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 6 mm (0.25-inch) bolt size and not less than 28 mm (1.125 inch) in embedment.

b. Power set fasteners not less than 6 mm (0.25-inch) diameter with depth of penetration not less than 75 mm (3 inch).

c. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.

F. Hollow Masonry: Toggle bolts.

G. Bolts supported only by plaster or gypsum wallboard are not acceptable.

H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

K. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.

L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.11 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 600 mm (24 inch) center-to-center lateral spacing shall be maintained between boxes.

F. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface- style flat or raised covers.

G. Minimum size of outlet boxes for ground fault circuit interrupter (GFCI) receptacles is 100 mm (4 inches) square x 55 mm (2.125 inches) deep, with device covers for the wall material and thickness involved.

H. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example, "SIG-FA JB No. 1."

I. On all branch circuit junction box covers, identify the circuits with black marker.

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SECTION 26 05 73

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the overcurrent protective device coordination study, related calculations and analysis, indicated as the study in this section.

B. A short-circuit and selective coordination study, and arc flash calculations and analysis shall be prepared for the electrical overcurrent devices to be installed under this project.

C. The study shall present a well-coordinated time-current analysis of each overcurrent protective device from the individual device up to the utility source and the on-site generator sources.

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 24 13, DISTRIBUTION SWITCHBOARDS: Low-voltage distribution switchboards.

C. Section 26 24 16, PANELBOARDS: Low-voltage panelboards.

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.

B. The study shall be prepared by the equipment manufacturer and performed by the equipment manufacturer’s licensed electrical engineer.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Complete study as described in paragraph 1.6. Submittal of the study shall be well-coordinated with submittals of the shop drawings for equipment in related specification sections.
2. Certifications: Two weeks prior to final inspection, submit the following.

a. Certification by the Contractor that the overcurrent protective

devices have been set in accordance with the approved study.

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. Institute of Electrical and Electronics Engineers (IEEE):

241-90.....RECOMMENDED PRACTICE ELECTRICAL SYSTEMS IN COMMERCIAL BUILDINGS

242-03.....RECOMMENDED PRACTICE FOR PROTECTION AND COORDINATION OF INDUSTRIAL AND COMMERCIAL POWER SYSTEMS

399-97.....RECOMMENDED PRACTICE FOR INDUSTRIAL AND COMMERCIAL POWER SYSTEMS ANALYSIS

1584-02.....PERFORMING ARC-FLASH HAZARDS CALCULATIONS

1584A-04.....PERFORMING ARC-FLASH HAZARDS CALCULATIONS – AMENDMENT 1

1584B-11.....PERFORMING ARC-FLASH HAZARDS CALCULATIONS – AMENDMENT 2

C. National Fire Protection Association (NFPA):

70-17.....NATIONAL ELECTRICAL CODE (NEC)

70E-18.....STANDARD FOR ELECTRICAL SAFETY IN THE WORKPLACE

99-18.....HEALTH CARE FACILITIES CODE

1.6 STUDY REQUIREMENTS

A. The study shall be in accordance with IEEE and NFPA standards.

B. The study shall include one-line diagram, short-circuit and ground fault analysis, protective coordination plots for all overcurrent protective devices, and arc flash calculations and analysis.

C. One Line Diagram:

1. Show all electrical equipment and wiring to be protected by the overcurrent devices.
2. Show the following specific information:

a. Calculated fault impedance, X/R ratios, and short-circuit values at each feeder and branch circuit bus.

b. Relay, circuit breaker, and fuse ratings.

c. Generator kW/kVA and transformer kVA and voltage ratings, percent

impedance, X/R ratios, and wiring connections.

d. Voltage at each bus.

e. Identification of each bus, matching the identification on the drawings.

f. Conduit, conductor, and busway material, size, length, and X/R ratios.

D. Short-Circuit Study:

1. The study shall be performed using computer software designed for this purpose. Pertinent data and the rationale employed in developing the calculations shall be described in the introductory remarks of the study.
2. Calculate the fault impedance to determine the available short-circuit and ground fault currents at each bus. Incorporate applicable motor and/or generator contribution in determining the momentary and interrupting ratings of the overcurrent protective devices.
3. Present the results of the short-circuit study in a table. Include the following:
   a. Device identification.
   b. Operating voltage.
   c. Overcurrent protective device type and rating.
   d. Calculated short-circuit current.

E. Coordination Study:

1. Prepare the coordination curves to determine the required settings of overcurrent protective devices to demonstrate selective coordination. Graphically illustrate on log-log paper that adequate time separation exists between devices, including the utility company upstream device if applicable. Plot the specific
   time-current characteristics of each overcurrent protective device in such a manner that all devices are clearly depicted.
2. The following specific information shall also be shown on the coordination curves:
   a. Device identification.
   b. Potential transformer and current transformer ratios.
   c. Three-phase and single-phase ANSI damage points or curves for each cable, transformer, or generator.

d. Applicable circuit breaker or protective relay characteristic curves.

e. No-damage, melting, and clearing curves for fuses.

f. Transformer in-rush points.

3. Develop a table to summarize the settings selected for the overcurrent protective devices. Include the following in the table:

a. Device identification.

b. Protective relay or circuit breaker potential and current transformer ratios, sensor rating, and available and suggested pickup and delay settings for each available trip characteristic.

c. Fuse rating and type.

F. Arc Flash Calculations and Analysis:

1. Arc flash warning labels shall comply with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
2. Arc flash calculations shall be based on actual over-current protective device clearing time. Maximum clearing time shall be in accordance with IEEE 1584.
3. Arc flash analysis shall be based on the lowest clearing time setting of the over-current protective device to minimize the incident energy level without compromising selective coordination.
4. Arc flash boundary and available arc flash incident energy at the corresponding working distance shall be calculated for all electrical power distribution equipment specified in the project, and as shown on the drawings.
5. Required arc-rated clothing and other PPE shall be selected and specified in accordance with NFPA 70E.

1.7 ANALYSIS

A. Analyze the short-circuit calculations, and highlight any equipment determined to be underrated as specified. Propose solutions to effectively protect the underrated equipment.

1.8 ADJUSTMENTS, SETTINGS, AND MODIFICATIONS

A. Final field settings and minor modifications of the overcurrent protective devices shall be made to conform with the study, without additional cost to the Government.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

- - - E N D - - -

SECTION 26 08 00
COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 26.

B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIRMENTS. A Commissioning Agent (CxA) appointed by the VA will manage the commissioning process.

1.2 RELATED WORK

A. Section 01 00 00 GENERAL REQUIREMENTS.

B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 SUMMARY

A. This Section includes requirements for commissioning the Facility electrical systems, related subsystems and related equipment. This Section supplements the general requirements specified in Section 01 91 00 General Commissioning Requirements.

B. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.4 DEFINITIONS

A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.5 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in Division 26 is part of the construction process. Documentation and testing of these systems, as well as training of the VA’s Operation and Maintenance personnel in accordance with the requirements of Section 01 91 00 and of Division 26, is required in cooperation with the VA and the Commissioning Agent.

B. The Facility electrical systems commissioning will include the systems listed in Section 01 91 00 General Commissioning Requirements:

1.6 SUBMITTALS

A. The commissioning process requires review of selected Submittals that pertain to the systems to be commissioned. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONSTRUCTION INSPECTIONS

A. Commissioning of Electrical systems will require inspection of individual elements of the electrical systems construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 00 and the Commissioning plan to schedule electrical systems inspections as required to support the Commissioning Process.

3.2 PRE-FUNCTIONAL CHECKLISTS

A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the

type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.3 CONTRACTORS TESTS

A. Contractor tests as required by other sections of Division 26 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

3.5 TRAINING OF VA PERSONNEL

A. Training of the VA operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit training agendas and trainer resumes in accordance with the requirements of Section 01 91 00. The instruction shall be scheduled in coordination with the VA Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 26 Sections for additional Contractor training requirements.

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SECTION 26 09 23
LIGHTING CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation and connection of the line voltage lighting controls.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): 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 24 16, PANELBOARDS: Panelboard enclosure and interior bussing used for lighting control panels.

E. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

F. Section 26 51 00, INTERIOR LIGHTING: Luminaire ballasts and drivers used in control of 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 controls.
   b. Material and construction details.
   c. Physical dimensions and description.
   d. Wiring schematic and connection diagram.
   e. Installation details.

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 lighting control 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. National Electrical Manufacturer's Association (NEMA):

C136.10-10.....AMERICAN NATIONAL STANDARD FOR ROADWAY AND AREA LIGHTING EQUIPMENT—LOCKING-TYPE PHOTOCONTROL DEVICES AND MATING RECEPTACLES—PHYSICAL AND ELECTRICAL INTERCHANGEABILITY AND TESTING

ICS-1-15.....STANDARD FOR INDUSTRIAL CONTROL AND SYSTEMS GENERAL REQUIREMENTS

ICS-2-05.....STANDARD FOR INDUSTRIAL CONTROL AND SYSTEMS: CONTROLLERS, CONTRACTORS, AND OVERLOAD RELAYS RATED NOT MORE THAN 2000 VOLTS AC OR 750 VOLTS DC: PART 8 - DISCONNECT DEVICES FOR USE IN INDUSTRIAL CONTROL EQUIPMENT

ICS-6-16.....STANDARD FOR INDUSTRIAL CONTROLS AND SYSTEMS ENCLOSURES

C. National Fire Protection Association (NFPA):

70-17.....NATIONAL ELECTRICAL CODE (NEC)

D. Underwriters Laboratories, Inc. (UL):

20-10.....STANDARD FOR GENERAL-USE SNAP SWITCHES

98-16.....ENCLOSED AND DEAD-FRONT SWITCHES

773-16.....STANDARD FOR PLUG-IN LOCKING TYPE PHOTOCONTROLS FOR USE WITH AREA LIGHTING

773A-16.....NONINDUSTRIAL PHOTOELECTRIC SWITCHES FOR LIGHTING CONTROL

916-15.....STANDARD FOR ENERGY MANAGEMENT EQUIPMENT SYSTEMS

917-06.....CLOCK OPERATED SWITCHES

924-16.....EMERGENCY LIGHTING AND POWER EQUIPMENT (FOR USE WHEN CONTROLLING EMERGENCY CIRCUITS).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC, manufacturer's instructions, as shown on the drawings, and as specified.

B. Locate ceiling-mounted occupancy sensor as per manufacturer’s recommendations.

C. Set occupancy sensor "on" duration as scheduled on drawings.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations.

B. Upon completion of installation, conduct an operating test to show that equipment operates in accordance with requirements of this section.

C. Test for full range of dimming ballast and dimming controls capability. Observe for visually detectable flicker over full dimming range.

D. Test occupancy sensors for proper operation. Observe for light control over entire area being covered.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting control devices are in good operating condition and properly performing the intended function in the presence of COR.

3.4 INSTRUCTION

A. Contractor shall submit written instructions on training and maintenance as reviewed in training session.

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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.

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 fault currents.

D. 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-15.....INTERNATIONAL BUILDING CODE

C. National Fire Protection Association (NFPA):
70-17.....NATIONAL ELECTRICAL CODE (NEC)

D. National Electrical Manufacturers Association (NEMA):
TR 1-13.....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 SPECIALTY TRANSFORMERS

UL 1561-11.....DRY-TYPE GENERAL PURPOSE AND POWER TRANSFORMERS

F. United States Department of Energy:

10 CFR PART 431.....ENERGY EFFICIENCY PROGRAM FOR CERTAIN COMMERCIAL AND INDUSTRIAL EQUIPMENT

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. Autotransformers 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).

b. Transformers below 30 kVA: Same as for 30 kVA and larger or UL rated 185 °C (365 °F) system with an average maximum rise by resistance of 115 °C (239 °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. Single phase transformers rated 15 kVA through 25 kVA shall have two 5% full capacity taps below normal rated primary voltage. All transformers rated 30 kVA and larger shall have two 2.5% full capacity taps above, and four 2.5% full capacity taps below normal rated primary voltage.
10. Core assemblies shall be grounded to their enclosures with adequate flexible ground straps.
11. Enclosures:
    a. Comprised of not less than code gauge steel.
    b. Outdoor enclosures shall be NEMA 3R.
    c. 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.
    d. Ventilation openings shall prevent accidental access to live components.
    e. The enclosure at the factory shall be thoroughly cleaned and painted with manufacturer's prime coat and standard finish.
12. Standard NEMA features and accessories, including ground pad, lifting provisions, and nameplate with the wiring diagram and sound level indicated.
13. Dimensions and configurations shall conform to the spaces designated for their installations.
14. 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 manufacturer's recommended clearance from wall and adjacent equipment for air circulation. Minimum clearance shall be 150 mm (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.

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SECTION 26 24 13
DISTRIBUTION SWITCHBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of the low-voltage circuit-breaker distribution switchboards, indicated as switchboard(s) in this section. Note that the new panel distribution will be fused disconnect switches.

1.2 RELATED WORK

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 fault currents.

E. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit.

F. Section 26 05 73, OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY: Short circuit and coordination study, and requirements for a coordinated electrical system.

G. Section 26 43 13, SURGE PROTECTIVE DEVICES: Surge protective devices for switchboards.

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 FACTORY TESTS

A. Factory Tests shall be required.

B. Factory Tests shall be in accordance with Paragraph, MANUFACTURED PRODUCTS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL
INSTALLATIONS, and the following requirement:

1. Tests shall be conducted per NEMA PB 2.
2. Verify that circuit breaker sizes and types correspond to drawings, and the Overcurrent Protective Device Coordination Study.
3. Verify tightness of bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer’s published data.

4. Exercise all active components.
5. Perform an insulation-resistance test, phase to ground, on each bus section, with phases not under test grounded, in accordance with manufacturer's published data.
6. Perform insulation-resistance tests on control wiring with respect to ground. Applied potential shall be 500 V DC for 300-volt rated cable and 1000 V DC for 600-volt rated cable, or as required if solid-state components or control devices cannot tolerate the applied voltage.
7. If applicable, verify correct function of control transfer relays located in the switchboard with multiple control power sources.
8. Perform phasing checks on double-ended or dual-source switchboards to insure correct bus phasing from each source.

1.5 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. Switchboard shop drawings shall be submitted simultaneously with or after the Overcurrent Protective Device Coordination Study.
   b. Submit sufficient information to demonstrate compliance with drawings and specifications.
   c. Prior to fabrication of switchboards, submit the following data for approval:
      1) Complete electrical ratings.
      2) Circuit breaker sizes.
      3) Interrupting ratings.
      4) Safety features.
      5) Accessories and nameplate data.
      6) Switchboard one-line diagram, showing ampere rating, number of bars per phase and neutral in each bus run (horizontal and vertical), bus spacing, equipment ground bus, and bus material.
      7) Elementary and interconnection wiring diagrams.
      8) Technical data for each component.
      9) Dimensioned exterior views of the switchboard.

10) Dimensioned section views of the switchboard.
11) Floor plan of the switchboard.
12) Foundation plan for the switchboard.
13) Provisions and required locations for external conduit and wiring entrances.
14) Approximate design weights.

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) Schematic signal and control diagrams, with all terminals identified, matching terminal identification in the switchboard.
      2) Include information for testing, repair, trouble shooting, assembly, disassembly, and factory recommended/required periodic maintenance procedures and frequency.
      3) Provide a replacement and spare parts list. Include a list of tools and instruments for testing and maintenance purposes.
   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 switchboards conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the switchboards have been properly installed, adjusted, and tested.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

B. Institute of Engineering and Electronic Engineers (IEEE):

C37.13-15.....Low Voltage AC Power Circuit Breakers Used in Enclosures
C57.13-16.....Instrument Transformers
C62.41.1-02.....Surge Environment in Low-voltage (1000V and less) AC Power Circuits
C62.45-02.....Surge Testing for Equipment connected to Low-Voltage AC Power Circuits

C. International Code Council (ICC):
IBC-15.....International Building Code

D. National Electrical Manufacturer's Association (NEMA):
PB 2-11.....Deadfront Distribution Switchboards
PB 2.1-13.....Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less

E. National Fire Protection Association (NFPA):
70-17.....National Electrical Code (NEC)

F. Underwriters Laboratories, Inc.
(UL): 67-09.....Panelboards
489-16.....Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures 891-05.....Switchboards

5 PART 2 - PRODUCTS

2.1 GENERAL

A. Shall be in accordance with IEEE, NEMA, NFPA, UL, as shown on the drawings, and have the following features:

1. Switchboard shall be a complete, grounded, continuous-duty, integral assembly, dead-front, dead-rear, self-supporting, indoor type switchboard assembly for inside switchboard, tamperproof, weatherproof, outdoor type for outside switchboard assembly. Incorporate devices shown on the drawings and all related components required to fulfill operational and functional requirements.
2. Ratings shall not be less than shown on the drawings. Short circuit ratings shall not be less than the available fault current shown in the Overcurrent Protective Device Coordination Study.
3. Switchboard shall conform to the arrangements and details shown on the drawings.

6. Switchboards shall be assembled, connected, and wired at the factory so that only external circuit connections are required at the construction site. Split the structure only as required for shipping and installation. Packaging shall provide adequate protection against rough handling during shipment.
7. All non-current-carrying parts shall be grounded per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS for additional requirements.
8. Series rated switchboards are not allowed.

2.2 BASIC ARRANGEMENT

A. Type 1: Switchboard shall be front accessible with the following features:

1. Device mounting:
   a. Main breaker: Individually mounted and compartmented or group mounted with feeder breakers.
   b. Feeder breakers: Group mounted.
2. Section alignment: As shown on the drawings.
3. Accessibility:
   a. Main section line and load terminals: Front and side.
   b. Distribution section line and load terminals: Front.
   c. Through bus connections: Front and end.
4. Bolted line and load connections.
5. Full height wiring gutter covers for access to wiring terminals.

2.3 HOUSING

A. Shall have the following features:

1. Frames and enclosures:
   a. The assembly shall be braced with reinforcing gussets using bolted connections to assure rectangular rigidity.
   b. The enclosure shall be steel, leveled, and not less than the gauge required by applicable publications.
   c. Die-pierce the holes for connecting adjacent structures to ensure proper alignment, and to allow for future additions.
   d. All bolts, nuts, and washers shall be zinc-plated steel.

B. Finish:

1. All metal surfaces shall be thoroughly cleaned, phosphatized and factory primed prior to applying baked enamel or lacquer finish.

2. Provide a light gray finish for indoor switchboard.
3. Outdoor switchboard:
   a. Interior finish shall be light gray.
   b. Exterior finishes shall be as specified in the Section 09 06 00, SCHEDULE FOR FINISHES.
   c. The underside of the switchboard shall be treated with corrosion resistant compounds, epoxy resin or rubberized sealing compound.

2.4 BUSES

A. Bus Bars and Interconnections:
1. Provide copper phase and neutral buses, fully rated for the amperage as shown on the drawings for the entire length of the switchboard. Bus laminations shall have a minimum of 6 mm (1/4 inch) spacing.
2. Mount the buses on appropriately spaced insulators and brace to withstand the available short circuit currents.
3. The bus and bus compartment shall be designed so that the acceptable NEMA standard temperature rises are not exceeded.
4. Install a copper ground bus the full length of the switchboard assembly.
5. Main Bonding Jumper: An un-insulated copper bus, size as shown on drawings, shall interconnect the neutral and ground buses, when the switchboard is used to establish the system common ground point.
6. All bolts, nuts, and washers shall be zinc-plated steel. Bolts shall be torqued to the values recommended by the manufacturer.
7. Make provisions for future bus extensions by means of bolt holes or other approved method.

2.5 MAIN CIRCUIT BREAKERS

A. Switchboards: Provide molded case main circuit breakers as shown on the drawings. Circuit breakers shall be the solid-state adjustable trip type.
1. Trip units shall have field adjustable tripping characteristics as follows:
   a. Long time pickup.
   b. Long time delay.
   c. Short time pickup.
   d. Short time delay.
   e. Instantaneous.

f. Ground fault pickup.

g. Ground fault delay.

2. Breakers with same frame size shall be interchangeable with each other.

3. Breakers shall be fully rated.

2.6 FEEDER CIRCUIT BREAKERS

A. Provide molded case circuit breakers as shown on the drawings.

B. Non-adjustable Trip Molded Case Circuit Breakers: - (NOT USED)

C. Adjustable Trip Molded Case Circuit Breakers:

1. Provide molded case, solid state adjustable trip type circuit breakers.

2. Trip units shall have field adjustable tripping characteristics as follows:

a. Long time pickup.

b. Long time delay.

c. Short time pickup.

d. Short time delay.

e. Instantaneous.

f. Ground fault pickup.

g. Ground fault delay.

3. Breakers with same frame size shall be interchangeable with each other.

2.7 FUSED SWITCHES RATED 600 AMPERES AND LESS

Switches shall be in accordance with NEMA, NEC, UL, as specified, and as shown on the drawings.

Shall be NEMA classified General Duty (GD) for 240 V switches, and NEMA classified Heavy Duty (HD) for 480 V switches.

Shall have the following features:

Switch mechanism shall be the quick-make, quick-break type. Copper blades, visible in the open position.

An arc chute for each pole.

External operating handle shall indicate open and closed positions and have lock-open padlocking provisions.

Mechanical interlock shall permit opening of the door only when the switch is in the open position, defeatable to permit inspection.

Fuse holders for the sizes and types of fuses specified.

Solid neutral for each switch being installed in a circuit which includes a neutral conductor.

Ground lugs for each ground conductor.

Enclosures:

Shall be the NEMA types shown on the drawings.

Where the types of switch enclosures are not shown, they shall be the NEMA types most suitable for the ambient environmental conditions.

Shall be finished with manufacturer's standard gray baked enamel paint over pretreated steel.

FUSED SWITCHES RATED OVER 600 AMPERES TO 1200 AMPERES

Shall be the same as fused switches and shall be NEMA classified Heavy-Duty (HD).

2.8 SURGE PROTECTIVE DEVICES

A. Refer to Section 26 43 13, SURGE PROTECTIVE DEVICES.

2.9 METERING

A. Provide metering in switchboards with capability to connect to energy management systems.

2.10 OTHER EQUIPMENT

A. Furnish tools and accessories required for circuit breaker and switchboard test, inspection, maintenance, and proper operation.

B. Panelboards: Requirements for panelboards shown to be installed in the switchboard shall be as shown on the drawings and in Section 26 24 16, PANELBOARDS.

2.11 CONTROL WIRING

A. Switchboard control wires shall not be less than No. 14 AWG copper 600 volt rated. Install wiring complete at the factory, adequately bundled and protected. Provide separate control circuit fuses in each breaker compartment and locate for ease of access and maintenance.

2.12 NAMEPLATES AND MIMIC BUS

A. Nameplates: For Normal Power system, provide laminated black phenolic resin with white core with 12 mm (1/2 inch) engraved lettered nameplates next to each circuit breaker. For Essential Electrical System, provide laminated red phenolic resin with white core with 12 mm (1/2 inch) engraved lettered nameplates next to each circuit breaker. Nameplates shall indicate equipment served, spaces, or spares in accordance with one line diagram shown on drawings. Nameplates shall be mounted with plated screws on front of breakers or on equipment enclosure next to breakers. Mounting nameplates only with adhesive is not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install switchboards in accordance with the NEC, as shown on the drawings, and as recommended by the manufacturer.

B. Anchor switchboards with rustproof bolts, nuts, and washers not less than 13 mm (1/2 inch) diameter, in accordance with manufacturer’s instructions, and as shown on drawings.

C. In seismic areas, switchboards shall be adequately anchored and braced per details on structural contract drawings to withstand the seismic forces at the location where installed.

D. Exterior Location. Mount switchboard on concrete slab. Unless otherwise indicated, the slab shall be at least 200 mm (8 inches) thick, reinforced with a 150 by 150 mm (6 by 6 inches) No. 6 mesh placed uniformly 100 mm (4 inches) from the top of the slab. Slab shall be placed on a 150 mm (6 inches) thick, well-compacted gravel base. The top of the concrete slab shall be approximately 100 mm (4 inches) above the finished grade. Edges above grade shall have 12.5 mm (1/2 inch) chamfer. The slab shall be of adequate size to project at least 200 mm (8 inches) beyond the equipment. Provide conduit turnups and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 75 mm (3 inches) above slab surface. Concrete work shall be as specified in Section 03 30 00, CAST- IN-PLACE CONCRETE.

E. Interior Location. Mount switchboard on concrete slab. Unless otherwise indicated, the slab shall be at least 100 mm (4 inches) thick. The top of the concrete slab shall be approximately 100 mm (4 inches) above finished floor. Edges above floor shall have 12.5 mm (1/2 inch) chamfer. The slab shall be of adequate size to project at least 200 mm (8 inches) beyond the equipment. Provide conduit turnups and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 75 mm (3 inches) above slab surface. Concrete work shall be as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

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, required area clearances, and correct alignment.
d. Verify that circuit breaker sizes and types correspond to approved shop drawings.
e. Verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method or performing thermographic survey after energization.
f. Vacuum-clean switchboard enclosure interior. Clean switchboard enclosure exterior.
g. Inspect insulators for evidence of physical damage or contaminated surfaces.
h. Verify correct shutter installation and operation.
i. Exercise all active components.
j. Verify the correct operation of all sensing devices, alarms, and indicating devices.
k. Verify that vents are clear.

2. Electrical tests:
a. Perform insulation-resistance tests on each bus section.
b. Perform insulation-resistance test on control wiring; do not perform this test on wiring connected to solid-state components.
c. Perform phasing check on double-ended switchboards to ensure correct bus phasing from each source.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the switchboard is in good operating condition and properly performing the intended function.

3.4 WARNING SIGN

A. Mount on each entrance door of the outdoor switchboard enclosure switchboard room, approximately 1500 mm (5 feet) above grade or floor, a clearly lettered warning sign for warning personnel. The sign shall be attached with rustproof metal screws.

3.5 ONE LINE DIAGRAM AND SEQUENCE OF OPERATION

A. At final inspection, an as-built one line diagram shall be laminated or mounted under acrylic glass and installed in a frame mounted in

the switchboard room or in the outdoor switchboard enclosure.

3.6 AS-LEFT TRIP UNIT SETTINGS

A. The trip unit settings shall be set in the field by an authorized representative of the switchboard manufacturer per the approved Electrical System Protective Device Study in accordance with Section 26 05 73, OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY.

B. Post a durable copy of the "as-left" trip unit settings in a convenient location Deliver four additional copies of the settings to the COTR. Furnish this information prior to the activation of the switchboard.

3.7 INSTRUCTION

A. Furnish the services of a factory-trained technician for one, 1-hour training period for instructing personnel in the maintenance and operation of the switchboards, on the dates requested by the COTR.

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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 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 fault currents.

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.

2. b. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, circuit breakers, wiring and connection diagrams, accessories, and nameplate data. Manuals:

a. 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 APPLCABLE 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-15.....INTERNATIONAL BUILDING CODE

C. National Electrical Manufacturers Association (NEMA): PB 1-11.....PANELBOARDS

250-14.....ENCLOSURES FOR ELECTRICAL EQUIPMENT (1,000V MAXIMUM)

D. National Fire Protection Association (NFPA):
70-17.....NATIONAL ELECTRICAL CODE (NEC)

70E-18.....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 200%rated, mounted on insulated supports.

H. Grounding bus bar shall be equipped with screws or lugs for the connection of equipment grounding conductors.

I. Bus bars shall be braced for the available short-circuit current as shown on the drawings, but not be less than 10,000 A symmetrical for 120/208 V and 120/240 V panelboards, and 14,000 A symmetrical for 277/480 V panelboards.

J. In two-section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side of main lugs only, or through-feed lugs for main breaker type panelboards and have field-installed cable connections to the second section as shown on the drawings. Panelboard sections with tapped bus or crossover bus are not acceptable.

K. Series-rated panelboards are not permitted.

2.2 ENCLOSURES AND TRIMS

A. Enclosures:

1. Provide galvanized steel enclosures, with NEMA rating as shown on the drawings or as required for the environmental conditions in which installed.
2. Enclosures shall not have ventilating openings.
3. Enclosures may be of one-piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.
4. Provide manufacturer's standard option for pre-punched 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.
2. 120/240 V Panelboard: 10,000 A symmetrical.
3. 277/480 V Panelboard: 14,000 A symmetrical.

D. Circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for less than 400 A frame. Circuit breakers with 400 A frames and above shall have magnetic trip, adjustable from 5x to 10x. Breaker trip setting shall be set in the field, based on the approved protective device study as specified in Section 26 05 71, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY.

E. Circuit breaker features shall be as follows:
1. A rugged, integral housing of molded insulating material.
2. Silver alloy contacts.
3. Arc quenchers and phase barriers for each pole.
4. Quick-make, quick-break, operating mechanisms.
5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
6. Electrically and mechanically trip free.

7. An operating handle which indicates closed, tripped, and open positions.
8. An overload on one pole of a multi-pole breaker shall automatically cause all the poles of the breaker to open.
9. Ground fault current interrupting breakers, shunt trip breakers, lighting control breakers (including accessories to switch line currents), or other accessory devices or functions shall be provided where shown on the drawings.
10. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory accordingly.

2.4 SURGE PROTECTIVE DEVICES

A. Where shown on the drawings, furnish panelboards with integral surge protective devices. Refer to Section 26 43 13, SURGE PROTECTIVE DEVICES.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the manufacturer’s instructions, the NEC, as shown on the drawings, and as specified.

B. Locate panelboards so that the present and future conduits can be conveniently connected.

C. Install a printed schedule of circuits in each panelboard after approval by the COR. 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.

D. Mount panelboards such that the maximum height of the top circuit breaker above the finished floor shall not exceed 1980 mm (78 inches).

E. Provide blank cover for each unused circuit breaker mounting space.

F. 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.

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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: Fluorescent ballasts and 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:

B. Shop Drawings:

1. Submit sufficient information to demonstrate compliance with drawings and specifications.
2. Include electrical ratings, dimensions, mounting details, construction materials, grade, and termination information.

C. Manuals:

1. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and information for ordering replacement parts.
2. 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.

D. Certifications: Two weeks prior to final inspection, submit the following.
   1. Certification by the manufacturer that the wiring devices conform to the requirements of the drawings and specifications.
   2. 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(R2015).....GENERAL COLOR REQUIREMENTS FOR WIRING DEVICES WD 6-16 .....WIRING DEVICES – DIMENSIONAL SPECIFICATIONS

C. National Fire Protection Association (NFPA):
   70-17.....NATIONAL ELECTRICAL CODE (NEC)
   99-18.....HEALTH CARE FACILITIES

D. Underwriter’s Laboratories, Inc. (UL):
   5-16.....SURFACE METAL RACEWAYS AND FITTINGS
   20-10.....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
   1449-14.....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. 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.
3. Tamper-Resistant Duplex Receptacles:
   a. Bodies shall be gray in color.
      1) Shall permit current to flow only while a standard plug is in the proper position in the receptacle.
      2) Screws exposed while the wall plates are in place shall be the tamperproof type.

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.

E. Surge Protective (TVSS) Receptacles shall have integral surge suppression in line to ground, line to neutral, and neutral to ground modes.
   1. TVSS Components: Multiple metal-oxide varistors; with a nominal

clamp-level rating of 400 Volts, and minimum single transient pulse energy dissipation of 210 Joules.

2. Active TVSS Indication: LED, visible in face of device to indicate device is active or no longer in service.

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.

B. Switches shall be rated 20 amperes at 120-277 Volts AC.

2.3 MANUAL DIMMING CONTROL

A. 0-10vdc 3 button raise/lower dimmer with on/off switch as scheduled on drawings.

B. Manual dimming controls shall be fully compatible with LED dimming driver and be approved by the driver manufacturer, shall operate over full specified dimming range, and shall not degrade the performance or rated life of the electronic dimming ballast and lamp.

C. Manual dimming control and faceplates shall be ivory in color unless otherwise specified.

2.4 WALL PLATES

A. Wall plates for switches and receptacles shall be smooth nylon type. 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.

E. Duplex Receptacles on Emergency Circuit: Wall plates shall be red nylon with the word "EMERGENCY" engraved in 6 mm (1/4 inch) white letters

2.5 SURFACE MULTIPLE-OUTLET ASSEMBLIES

A. Shall have the following features:

1. Enclosures:

a. Thickness of steel shall be not less than 1 mm (0.040 inch) for base and cover. Nominal dimensions shall be 40 mm x 70 mm (1-1/2 inches by 2-3/4 inches) with inside cross-sectional area not less than 2250 square mm (3-1/2 square inches). The enclosures shall be thoroughly cleaned, phosphatized, and painted at the factory with primer and the manufacturer's standard baked enamel finish.

2. Receptacles shall be duplex, hospital grade. See paragraph 'RECEPTACLES' in this Section. Device cover plates shall be the manufacturer's standard corrosion resistant finish and shall not exceed the dimensions of the enclosure.

3. Unless otherwise shown on drawings, receptacle spacing shall be 600 mm (24 inches) on centers.

4. Conductors shall be as specified in Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE.

5. Installation fittings shall be the manufacturer’s standard bends, offsets, device brackets, inside couplings, wire clips, elbows, and other components as required for a complete system.

6. Bond the assemblies to the branch circuit conduit system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC and as shown as on the drawings.

B. Install wiring devices after wall construction and painting is complete.

C. The ground terminal of each wiring device shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the branch circuit equipment grounding conductor.

D. Outlet boxes for toggle switches 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 1.2 M (48 inches) above floor, with the toggle OFF position down.

I. Install wall dimmers 1.2 M (48 inches) above floor.

J. Install receptacles 450 mm (18 inches) above floor, and 152 mm (6 inches) above counter backsplash or workbenches. Install specific-use receptacles at heights shown on the drawings.

K. Install horizontally mounted receptacles with the ground pin to the right.

L. When required or recommended by the manufacturer, use a torque screwdriver. Tighten unused terminal screws.

M. 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.
2. Receptacle testing in the Patient Care Spaces, such as retention force of the grounding blade of each receptacle, shall comply with the latest NFPA 99.

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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

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 faults.

E. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

F. Section 26 24 16, PANELBOARDS: Molded-case circuit breakers.

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.
   c. Certification from the manufacturer that representative enclosed switches and circuit breakers have been seismically tested to International Building Code requirements. Certification shall be based upon simulated seismic forces on a shake table or by analytical methods, but not by experience data or other methods.

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 1-12..... Low Voltage Cartridge Fuses
KS 1-13..... 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.
   10. Electrically operated switches shall only be installed where shown on the drawings.

2.2 UNFUSED SWITCHES RATED 600 AMPERES AND LESS

A. Shall be the same as fused switches, but without provisions for fuses.

2.3 FUSED SWITCHES RATED OVER 600 AMPERES TO 1200 AMPERES

A. Shall be the same as fused switches and shall be NEMA classified Heavy Duty (HD).

2.4 MOTOR RATED TOGGLE SWITCHES

A. Type 1, general purpose for single-phase motors rated up to 1 horsepower.
B. Quick-make, quick-break toggle switch with external reset button and thermal overload protection matched to nameplate full-load current of actual protected motor.

2.5 CARTRIDGE FUSES

A. Shall be in accordance with NEMA FU 1.
B. Feeders: Class RK5, fast acting or Class RK5, time delay depending on coordination study.

C. Other Branch Circuits: Class RK1, time delay or Class RK5, time delay

2.6 SEPARATELY-ENCLOSED CIRCUIT BREAKERS

A. Provide circuit breakers in accordance with the applicable requirements in Section 26 24 16, PANELBOARDS.

B. Enclosures shall be the NEMA types shown on the drawings. Where the types are not shown, they shall be the NEMA type most suitable for the ambient environmental conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the 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.

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SECTION 26 43 13
SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of Type 2 Surge Protective Devices, as defined in NFPA 70, and indicated as SPD in this section.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
B. Section 26 23 00, LOW-VOLTAGE SWITCHGEAR: For factory-installed or external SPD.
C. Section 26 24 13, DISTRIBUTION SWITCHBOARDS: For factory-installed or external SPD.
D. Section 26 24 16, PANELBOARDS: For factory-installed or external SPD.
E. Section 26 26 00, POWER DISTRIBUTION UNITS FOR STATIC UNINTERRUPTIBLE POWER SYSTEMS: For factory-installed or external SPD.

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 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, 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 manufacturer that the SPD conforms to the requirements of the drawings and specifications.

b. Certification by the Contractor that the SPD has been properly installed.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplement and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. Institute of Engineering and Electronic Engineers (IEEE):

IEEE C62.41.2-02..... Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

IEEE C62.45-08..... Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits

C. National Fire Protection Association (NFPA):

70-23..... National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):

UL 1283-17..... Electromagnetic Interference Filters

UL 1449-21..... Surge Protective Devices

PART 2 - PRODUCTS

2.1 SWITCHGEAR/SWITCHBOARD SPD

A. General Requirements:

1. Comply with IEEE and UL.
2. Modular design with field-replaceable modules, or non-modular design.
3. Fuses, rated at 200 kA interrupting capacity.
4. Bolted compression lugs for internal wiring.
5. Integral disconnect switch.
6. Redundant suppression circuits.
7. LED indicator lights for power and protection status.
8. Audible alarm, with silencing switch, to indicate when protection has failed.
9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.
10. Four-digit transient-event counter.

B. Surge Current per Phase: Minimum 240kA per phase.

2.2 PANELBOARD SPD

A. General Requirements:

1. Comply with UL 1449 and IEEE C62.41.2.
2. Modular design with field-replaceable modules, or non-modular design.
3. Fuses, rated at 200 kA interrupting capacity.

4. Bolted compression lugs for internal wiring.
5. Integral disconnect switch.
6. Redundant suppression circuits.
7. LED indicator lights for power and protection status.
8. Audible alarm, with silencing switch, to indicate when protection has failed.
9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.
10. Four-digit transient-event counter.

B. Surge Current per Phase: Minimum 120kA per phase.

2.3 ENCLOSURES

A. Enclosures: NEMA 1.

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. Factory-installed SPD: Switchgear, switchboard, or panelboard manufacturer shall install SPD at the factory.
C. Field-installed SPD: Contractor shall install SPD with conductors or buses between SPD and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
   1. Provide a circuit breaker as a dedicated disconnecting means for TVSS as shown on drawings.
D. Do not perform insulation resistance tests on switchgear, switchboards, panelboards, or feeders with the SPD connected. Disconnect SPD before conducting insulation resistance tests, and reconnect SPD immediately after insulation resistance tests are complete.

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 that disconnecting means and feeder size and maximum length to SPD corresponds to approved shop drawings.

d. Verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method.
e. Vacuum-clean enclosure interior. Clean enclosure exterior.
f. Verify the correct operation of all sensing devices, alarms, and indicating devices.

3.3 FOLLOW-UP VERIFICATION

A. After completion of acceptance checks and tests, the Contractor shall show by demonstration in service that SPD are in good operating condition and properly performing the intended function.

3.4 INSTRUCTION

A. Provide the services of a factory-trained technician for one 2-hour training period for instructing personnel in the maintenance and operation of the SPD, on the date requested by the COR.

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SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of exterior fixtures, poles, and supports. The terms "lighting fixtures", "fixture" and "luminaire" are used interchangeably.

1.2 RELATED WORK

A. Section 09 06 00, SCHEDULE FOR FINISHES: Finishes for exterior light poles and luminaires.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.

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, fittings, and boxes for raceway systems.

F. Section 26 09 23, LIGHTING CONTROLS: Controls for exterior lighting.

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.
j. Submit site plan showing all exterior lighting fixtures with fixture tags consistent with Lighting Fixture Schedule as shown on drawings. Site plan shall show computer generated point-by-point illumination calculations. Include lamp lumen and light loss factors used in calculations.

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 exterior 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 National Standards Institute (ANSI):
H35.1/H35 1M-17..... American National Standard Alloy and Temper Designation Systems for Aluminum

C. American Society for Testing and Materials (ASTM):
A123/A123M-17 ..... Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A153/A153M-16..... Zinc Coating (Hot-Dip) on Iron and Steel Hardware
B108/B108M-19 ..... Aluminum-Alloy Permanent Mold Castings
C1089-19 ..... Spun Cast Prestressed Concrete Poles

D. Illuminating Engineering Society of North America (IESNA):
LM-72-20..... Directional Positioning of Photometric Data
LM-79-19..... Approved Method for the Electrical and Photometric Measurements of Solid-Sate Lighting Products

LM-80-21..... Approved Method for Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules

TM-15-20..... Luminaire Classification System for Outdoor Luminaires

E. National Fire Protection Association (NFPA):

70-23 ..... National Electrical Code (NEC)

101-21..... Life Safety Code

F. Underwriters Laboratories, Inc. (UL):

773A-16 ..... Nonindustrial Photoelectric Switches for Lighting Control

1598-21 ..... Luminaires

8750-15.....Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.6 DELIVERY, STORAGE, AND HANDLING

Provide manufacturer's standard provisions for protecting pole finishes during transport, storage, and installation. Do not store poles on ground. Store poles so they are at least 305 mm (12 inches) above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

Luminaires, materials and equipment shall be in accordance with NEC, UL, ANSI, and as shown on the drawings and specified.

2.2 LUMINAIRES

A. Luminaires shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp and ballast heat, and safe cleaning and relamping.

B. Illumination distribution patterns, BUG ratings and cutoff types as defined by the IESNA shall be as shown on the drawings.

C. Incorporate ballasts in the luminaire housing, except where otherwise shown on the drawings.

D. Lenses shall be frame-mounted, heat-resistant, borosilicate glass, with prismatic refractors, unless otherwise shown on the drawings. Attach the frame to the luminaire housing by hinges or chain. Use heat and aging-resistant, resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

E Pre-wire internal components to terminal strips at the factory.

F. Bracket-mounted luminaires shall have leveling provisions and clamp-type adjustable slip-fitters with locking screws.

G Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.

H. Provide manufacturer's standard finish, as scheduled on the drawings. Where indicated on drawings, match finish process and color of pole or support materials. Where indicated on drawings, provide finishes as indicated in Section 09 06 00, SCHEDULE FOR FINISHES.

I. Luminaires shall carry factory labels, showing complete, specific lamp and ballast information.

2.3 LAMPS

A. Lamps shall be general-service, outdoor lighting types.

B. LED sources shall meet the following requirements:

1. Operating temperature rating shall be between -40 degrees C (-40 degrees F) and 50 degrees C (120 degrees F).
2. Correlated Color Temperature (CCT): 5000K.
3. Color Rendering Index (CRI):≥ 80.
4. The manufacturer shall have performed reliability tests on the LEDs luminaires complying with Illuminating Engineering Society (IES) LM79 for photometric performance and LM80 for lumen maintenance and L70 life.

C. Mercury vapor lamps shall not be used.

2.4 LED DRIVERS

A. LED drivers shall meet the following requirements:

1. Drivers shall have a minimum efficiency of 85%.
2. Starting Temperature: -40 degrees C (-40 degrees F).
3. Input Voltage: 120 to 480 (±10%) volts.
4. Power Supplies: Class I or II output.
5. Surge Protection: The system must survive 250 repetitive strikes of “C Low” (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. “C Low” waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
6. Power Factor (PF): ≥ 0.90.
7. Total Harmonic Distortion (THD): ≤ 20%.
8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer’s recommendations.
interior of the pole.

B. Install lamps in each luminaire.

C. Adjust luminaires that require field adjustment or aiming.

3.2 GROUNDING

Ground noncurrent-carrying parts of equipment, including metal poles, luminaires, mounting arms, brackets, and metallic enclosures, as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable and listed for this purpose.

3.3 ACCEPTANCE CHECKS AND TESTS

Verify operation after installing luminaires and energizing circuits.

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SECTION 28 23 00
VIDEO SURVEILLANCE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Provide and install a complete Video Surveillance System, hereinafter referred to as the VSS System as specified in this section.

B. This Section includes video surveillance system consisting of cameras, data transmission wiring, and a control station with its associated equipment.

C. *Video surveillance system Video assessment & surveillance system shall be integrated with monitoring and control system specified in Division 28 Section [INTRUSION DETECTION] [PHYSICAL ACCESS CONTROL] [SECURITY ACCESS DETECTION] [ELECTRONIC PERSONAL PROTECTION SYSTEM] that specifies systems integration.*

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 10 14 00 - SIGNAGE. Requirements for labeling and signs.

D. Section 14 21 00 - ELECTRIC TRACTION ELEVATORS. Requirements for elevators.

E. Section 14 24 00 - HYDRAULIC ELEVATORS. Requirements for elevators.

F. Section 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.

G. Section 26 05 21 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.

H. Section 26 05 41 - UNDERGROUND ELECTRICAL CONSTRUCTION. Requirements for underground installation of wiring.

I. Section 26 56 00 - EXTERIOR LIGHTING. Requirements for perimeter lighting.

J. 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.

K. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.

L. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.

M. Section 28 05 28.33 - CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.

N. Section 28 08 00 - COMMISIONING OF ELECTRONIC SAFETY AND SECURITY. Requirements for commissioning, systems readiness checklists, and training.

O. Section 28 13 00 - PHYSICAL ACCESS CONTROL SYSTEM. Requirements for physical access control system integration.

P. Section 28 13 16 - PHYSICAL ACCESS CONTROL SYSTEM AND DATABASE MANAGEMENT. Requirements for control and operation of all security systems.

Q. Section 28 13 53 - SECURITY ACCESS DETECTION. Requirements for screening of personnel and shipments.

R. Section 28 16 00 - INTRUSION DETECTION SYSTEM (IDS). Requirements for alarm systems.

S. Section 28 26 00 - ELECTRONIC PERSONAL PROTECTION SYSTEM (EPPS). Requirements for emergency and interior communications.

1.3 DEFINITIONS

A. AGC: Automatic gain control.

B. B/W: Black and white.

C. CCD: Charge-coupled device.

F. H.265: is the recommended video encoding format.

G. ips: Images per second.

H. MPEG: Moving picture experts group.

I. MPEG4: a video encoding and compression standard that uses inter-frame encoding to significantly reduce the size of the video stream being transmitted.

J. Intentionally left blank

K. UPS: Uninterruptible power supply.

1.4 QUALITY ASSURANCE

A. The Contractor shall be responsible for designing, providing, installing, and putting into operation the VSS System as shown. The Contractor shall also provide certification as required.

B. The security system shall be installed and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the security system is stand-alone or a part of a complete Information Technology (IT) computer network.

C. The Contractor or security sub-contractor shall be a licensed security Contractor as required within the state or jurisdiction of where the installation work is being conducted.

D. 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.

E. 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.

F. 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 Video Assessment and Surveillance System’s (VSS) 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 VSS. The Contractor shall only utilize factory-trained technicians to install, terminate and service cameras, control, and recording equipment. 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 COTR 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.

G. 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 SUBMITTALS

A. Submit below items in conjunction with Master Specification Sections 01 33 23, Shop Drawings, Product Data, and Samples, and Section 02 41 00, Demolition Drawings.

B. Provide certificates of compliance with Section 1.4, Quality Assurance.

C. Provide a pre-installation and as-built design package in both electronic format and on paper, minimum size 1220 x 1220 millimeters (48 x 48 inches); drawing submittals shall be per the established project schedule.

D. Pre-installation design and as-built packages shall include, but not be limited to:

1. Index Sheet that shall:

a. Define each page of the design package to include facility name, building name, floor, and sheet number.

b. Provide a list of all security abbreviations and symbols.

c. Reference all general notes that are utilized within the design package.

d. Specification and scope of work pages for all security systems that are applicable to the design package that will:

1) Outline all general and job specific work required within the design package.

2) Provide a device identification table outlining device Identification (ID) and use for all security systems equipment utilized in the design package.

2. Floor plans, site plans, and enlarged plans shall:

a. Include a title block as defined above.

b. Define the drawings scale in both standard and metric measurements.

c. Provide device identification and location.

d. Address all signal and power conduit runs and sizes that are associated with the design of the electronic security system and other security elements (e.g., barriers, etc.).

e. Identify all pull box and conduit locations, sizes, and fill capacities.

f. Address all general and drawing specific notes for a particular drawing sheet.

3. A riser drawing for each applicable security subsystem shall:

a. Indicate the sequence of operation.

b. Relationship of integrated components on one diagram.

c. Include the number, size, identification, and maximum lengths of interconnecting wires.

d. Wire/cable types shall be defined by a wire and cable schedule. The schedule shall utilize a lettering system that will correspond to the wire/cable it represents (example: A = 18 AWG/1 Pair Twisted, Unshielded). This schedule shall also provide the manufacturer’s name and part number for the wire/cable being installed.

4. A system drawing for each applicable security system shall:

a. Identify how all equipment within the system, from main panel to device, shall be laid out and connected.

b. Provide full detail of all system components wiring from point-to-point.

c. Identify wire types utilized for connection, interconnection with associate security subsystems.

d. Show device locations that correspond to the floor plans.

e. All general and drawing specific notes shall be included with the system drawings.

5. A schedule for all of the applicable security subsystems shall be included. All schedules shall provide the following information:

a. Device ID.

b. Device Location (e.g. site, building, floor, room number, location, and description).

c. Mounting type (e.g. flush, wall, surface, etc.).

d. Power supply or circuit breaker and power panel number.

e. In addition, for the VSS Systems, provide the camera ID, camera type (e.g. fixed or pan/tilt/zoom (P/T/Z), lens type (e.g. for fixed cameras only) and housing model number.

6. Detail and elevation drawings for all devices that define how they were installed and mounted.

E. Pre-installation design packages shall be reviewed by the Contractor along with a VA representative to ensure all work has been clearly defined and completed. All reviews shall be conducted in accordance with the project schedule. F. Provide manufacturer security system product cut-sheets. Submit for approval at least 30 days prior to commencement of formal testing, a Security System Operational Test Plan. Include procedures for operational testing of each component and security subsystem, to include performance of an integrated system test.

G. Submit manufacture’s certification of Underwriters Laboratories, Inc. (UL) listing as specified. Provide all maintenance and operating manuals per the VA General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

H. Submit 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.

1.6 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)/Electronic Industries Alliance (EIA):

330-09Electrical Performance Standards for CCTV Cameras

375A-76 Electrical Performance Standards for CCTV Monitors

C. Institute of Electrical and Electronics Engineers (IEEE):

C62.41-02 IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

802.3af-08 Power over Ethernet Standard

D. Federal Communications Commision (FCC):

(47 CFR 15) Part 15 Limitations on the Use of Wireless Equipment/Systems

E. National Electrical Contractors Association (NECA):

303-2005 Installing Closed Circuit Television (CCTV) Systems

F. National Fire Protection Association (NFPA):

70-08 Article 780-National Electrical Code

G. Federal Information Processing Standard (FIPS):

140-2-02 Security Requirements for Cryptographic Modules

H. Underwriters Laboratories, Inc. (UL):

983-06Standard for Surveillance Camera Units

3044-01 Standard for Surveillance Closed Circuit Television Equipment

1.7 COORDINATION

A. Coordinate arrangement, mounting, and support of video surveillance equipment:

1. To allow maximum possible 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 video surveillance items that are behind finished surfaces or otherwise concealed.

1.8 WARRANTY OF CONSTRUCTION

A. Warrant VSS System work subject to the Article “Warranty of Construction” of FAR clause 52.246-21.

B. Demonstration and training shall be performed prior to system acceptance.

PART 2 – PRODUCTS

2.1 GENERAL

A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.

B. Power Connections: Comply with requirements in Section 28 05 00 COMMON WORK REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY, Part 2, as recommended by manufacturer for type of line being protected.

C. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station, control-unit alarm display shall identify tamper alarms and indicate locations.

2.2 CAMERAS

A. All Cameras will be EIA 330 and UL 1.Minimum Protection for Power Connections 120 V and more: Auxiliary panel suppressors shall comply with requirements in Section 28 05 00 COMMON WORK REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY, Part 2.

B. Minimum Protection for Communication, Signal, Control, and Low-Voltage 983 compliant as well as:

1. Will be charge coupled device (CCD)
2. Fixed cameras shall be color and the primary choice for monitoring following the activities described below.
3. Intentionally left blank
4. Shall be powered over Ethernet. Network switches supporting PoE cameras shall have a back-up power source to ensure cameras are still operational in the event of loss of primary power to the VSS System.
5. Shall be rated for continuous operation under the environmental conditions listed in Part 1, Project Conditions.
6. Intentionally left blank
7. Each function and activity shall be addressed within the system by a unique user defined name, with minimum of twenty (20) characters. The use of codes or mnemonics identifying the VSS action shall not be accepted.

8. Shall come with built-in video motion detection that shall automatically monitor and process information from each camera. The camera motion detection shall detect motion within the camera's field of view and provide automatic visual, remote alarms as a result of detected motion.
9. Shall be programmed to digitally flip from color to black and white at dusk and vice versa at low light conditions.
10. Will be fitted with AI/DC lenses to ensure the image quality under different light conditions.
11. P/T/Z cameras shall be utilized in a manner that they complement fixed cameras and shall not be used as a primary means of monitoring activity.
12. Dummy or fake cameras will not be utilized at any time.
13. Appropriate signage shall be designed, provided, and posted that notifies people that an area is under camera surveillance.

2.3 VIDEO MANAGEMENT SYSTEM

A. The Video Management System (VMS)shall provide features and functions as specified below:
1. Supports unlimited client connections.
2. The Video Management System shall be capable of recording 15 images per second, per camera, 24/7 no less than **90 days of storage. No motion-based recording.** TB of internal hard drive storage should be calculated using the following parameters:
a. Quality – Normal
d. Sensitivity – Normal
e. Record Audio – Off
3. The Digital Video Management System shall, at a minimum, combine alarm detection, video motion detection, video, audio, and metadata recording.
B. System Chassis
1. The Video Management System must utilize a chassis no larger than three rack units in height, and be suitable for either desktop or rack mount installations. The unit must fit within a standard video rack as well as a server rack.
2. The Video Management System’s chassis shall include three indicator lights easily viewed from the front panel. These indicator lights must be colored red, yellow, and green to signify system status.
3. The Video Management System’s chassis shall incorporate a minimum of four front accessible, swappable drive bays. The bays must be behind a

locking front cover that restricts access not only to the drives, but also to the power switch and reset switch.

C. Operating System

1. The Video Management System's operating system and application must be installed on a separate solid-state system drive (flash memory card), with no moving parts to wear out or fail, to reduce the risk of system failure. Units with the operating system and/or application installed on a hard drive are not acceptable.

D. Recording

1. The Digital Video Management System shall use record mode settings as continuous or event activated.

2. The Digital Video Management System shall provide for simultaneous recording, playback, transmitting, database searching and archiving.

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4. The unit must be capable of simultaneously record, play back and archive video, metadata and audio while using sophisticated search functions to define and find only those important events that meet certain criteria. The system must also have the ability to host multiple remote users, archive data, and search for data, all while recording multiple video and metadata streams.

5. The Video Management System shall have the ability to capture critical information with higher frame rates for certain cameras, and assign the remainder of the available images per second (ips) to non-critical cameras.

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7. Intentionally left blank

8. The Video Management System's recording format must give each image a unique identification "stamp" to ensure even though the file structure is PC compatible, the original video images cannot be altered or modified, enabling a solid chain of evidence.

9. The Video Management System shall be able to store recorded video on the RAID Storage System (RSS) via an iSCSI interface.

10. The Video Management System shall be able to manage storage of video, audio and metadata by exporting to Network Attached Storage (NAS), Storage Area Network (SAN) and Direct Attached Storage (DAS) devices using optional software.

11. The system shall provide option to set up the Video Management System in advanced security mode to enable both IT and security managers to

collectively integrate the unit into existing IT network without compromising the security protocols in place.

E. Network Access

1. The Video Management System shall provide network access through two internal network connections that support 1 and 10 Gbps network operation.

F. User Interface

1. The Video Management System's user interface must be easy to use, allowing the user to access all operations using one-click buttons, pull-down menus, adjustable sliders, and tabbed screens.

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3. The system shall provide ability for user to specify metadata criteria, such as a specific ASCII text string, to schedule recording and search for video, allowing for recording only the video associated with the specified text.

G. Live Video Display

1. The Digital Video Management System's live video display must provide real-time motion in any screen format (full, 2x2, 3x3, and 4x4). The operator shall have the ability to expand any view to full screen with a single click of the mouse.

H. Self-Monitoring Analysis

1. The Digital Video Management System must incorporate Self-Monitoring Analysis and Reporting Technology (S.M.A.R.T.), incorporating a suite of advanced diagnostics that monitor the internal operation of a drive and provide early warning for many types of potential problems. This shall allow for the drive to be repaired or replaced before any data is lost or damaged.

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J. Alarm Recording Settings:

1. The Digital Video Management System shall allow for the following Alarm Recording settings:

a. Image Rate

b. Quality

c. Sensitivity

K. Adjustable Alarm Duration

1. The Digital Video Management System shall incorporate an adjustable alarm duration with the pre-alarm and minimum alarm duration programmable from five seconds to five minutes. The units must also allow programmable recording times (alarm schedules) for each day of the week, in thirty minute increments.

L. Supported Dome Camera handlers

M. Alarm-Triggered Dome Events

1. The Digital Video Management System must include alarm-triggered dome events, allowing the operator to configure domes to respond to alarm conditions via Network Client™ or Intellex GUI (using supported dome control handlers). The event can be a motion filter (motion detection, perimeter protection, light change and motion exception), a wired alarm, video loss, or a manually generated alarm. The unit must have the ability to move a single dome, or multiple domes, to preset positions or patterns. This feature must be supported by the dome.

N. Email Support

1. The Digital Video Management System must include the ability to send an email via an email server to anyone, or any group, based upon an event. The events must include, but not necessarily limited to, the following:

a. System Event

b. Video Loss

c. Generated Alarm

d. Any Filter Alarm

e. Any Input Alarm

f. Individual Camera Alarm

O. API Support

1. The Digital Video Management System shall easily integrate with third party software application using an Application Programmers Interface (API). The manufacturer of the unit shall offer a Software Developers Kit (SDK) to select third party manufactures, in addition to sample modular programs with their source codes in both Visual Basic and Visual C++, allowing programmers to develop their own software to control the unit’s functions.

2. The Digital Video Management System’s API must be backwards compatible with previous versions of the software equal to or greater than v3.2

P. Recorded Event Search

1. In order to instantly retrieve recorded video of any event, the Digital Video Management System shall use a patented search feature to filter through hours of video to find only the essential events. The operator must have the ability to isolate video containing motion, and find video where perimeters were crossed, lights were turned on or off, alarms were triggered, and numerous additional scenarios.

2. In addition to the standard motion based mode, using advanced video analysis tools, the Digital Video Management System shall enable the user to

schedule recording and search for video if the movement of an object meets specified size, speed, direction and Motion Exception criteria.

Q. Covert Camera Operation:

1. The Digital Video Management System shall include the ability to configure up to 15 cameras for “covert” operation, restricting their use to only those who are authorized.

R. Activity Log:

1. To provide for more effective security management, the Digital Video Management System must also allow for audits of the activity log to monitor changes to the settings and configurations. The activity log shall include, but not necessarily be limited to, the following information:

a. User Name – Login name of the user

b. Date/Time – Date and Time the action was performed

c. Access Loc – Whether the action was local to the unit or done through remote software

d. Category – The actions category

e. Activity – The action performed within the category

f. Data – Description of the action

2. The operator shall have the ability to export the entire log file, export the displayed log file, print the log file, or print the displayed log file locally and remotely through Network Client v4.3 software.

S. Antivirus Protection

1. The Digital Video Management System shall be compatible with the leading brands of anti-virus software in order to detect and deactivate malicious software that may attempt to attack the system.

T. Remote Configuration and Management software:

1. The Digital Video Management System must include support for Remote Configuration and Management software to allow a user to remotely configure the unit, view live video, or select video segments by time, date, alarm, or search results. The operator must have the ability to save, annotate, and organize copied video into “incident folders” to aid with investigations.

2. The remote management software must allow for up to 64 live video sessions, allowing the operator to view up to sixty four different cameras, from up to 64 different remote sites, simultaneously.

3. The remote management software shall also allow the exporting of video clips to an .avi file to play on any Microsoft Windows based PC. The software shall have the ability to enhance, print, or convert the individual images to standard formats.

4. The remote management software shall allow an operator to select units, cameras, and timeframes for automatic retrieval of video clips to an operators PC. This allows for downloads to be scheduled during times that network traffic restrictions are not an issue.

U. Playback and Multi-screen Playback

1. The Digital Video Management System shall incorporate playback and multi-screen playback functionality to allow the user to locate and select a single stored image to be enhanced using tools. The tools shall include, but not necessarily be limited to, the following:

a. Brightness
b. Contrast
c. Hue
d. Saturation
e. Lightness
f. Balance Light
g. Edge Detect
h. Enhance Light
i. Noise Reduction
j. Sharpen
k. Sharpen More
l. Smooth
m. Smooth More
n. Brightness Chart

V. Browser Client

1. A browser-based viewer (Browser Client) must also be available free of charge, enabling users to host and customize their own website to provide live viewing of the Digital Video Management System through a standard browser interface. Multiple viewers shall have the ability to access video and control domes remotely.

W. Minimum Performance Specifications

Power Supply	100-240 VAC, 50/60 Hz, 3.0/1.5A
Physical Characteristics:	Rack Mount Chassis Version Unit Dimensions (HxWxD) 130 mm (5.125”) High , 429 mm (16.895”) Wide, 546 mm (21.5”) Deep Rack Height Three (3) units Desktop Chassis Version(HxWxD)130 mm (5.125”) High429 mm (16.895”) Wide546 mm (21.5”) Deep

Environmental Requirements	Operating Temperature 5° to 35° C (41° to 95° F) Humidity 5%-95% RH non-condensing
Regulatory	Immunity EN50130-4 (1996) (An Uninterruptable Power Supply must be used to fully comply with EN50130-4)

2.4 DIGITAL BASED VIDEO MANAGEMENT SYSTEM

A. Key Features

1. Open Platform: Open API/SDK, supports seamless integration with third party applications.

2. Multi-server and multi-site video surveillance solution: Unlimited recording of video from IP cameras, and IP video encoders.

3. Optimized Recording Storage Management: Unique data storage and archiving solution that combines superior performance and scalability and cost efficient long-term video storage

4. Wide IP camera and device support: Supports connection of more than 839 IP cameras, IP video encoders and selected DVR models from over 79 different vendors through dedicated device integration

5. ONVIF™ and PSIA compliant: Supports ONVIF™ and PSIA compliant cameras and devices

6. Wide compression technology support: Supports the newest compression methods: MPEG4 ASP, MxPEG, H.264 and H.265, besides MJEPG and MPEG4.

7. System configuration wizards: Guides the user through the process of adding cameras, configuring video and recording, adjustment of motion detection and user configuration

8. Sequence Explorer: Displaying sequences and time intervals in thumbnail pre-views, the Sequence Explorer gives unparalleled visual overview of recorded video combined with smooth navigation

9. Overlay buttons: Intuitive control of cameras, camera-integrated devices and other integrated systems- directly from the camera view

10. Independent Playback: Instant and independent playback function allows you to independently playback recorded video for one or more cameras, while in live viewing or playback mode

11. Built-in Video Motion Detection: Independent of camera model and supporting up to 64 cameras simultaneously per server

12. Multiple language support: Let operators use the system in their native language with support for 20 different languages

13. Multi-channel, two-way audio: Communicate with people at gates/entrances or broadcast messages to many people at once with multichannel, two-way audio

14. Fast evidence export: Quickly deliver authentic evidence to public authorities by exporting video to various formats, including video from multiple cameras with viewer, logs, and user notes included

B. Administration Features

1. Single Management Application: A new Management Application provides a consolidated single point management access to Recording Servers.

2. System configuration wizards: Guides the user through the process of adding cameras, configuring video and recording, adjustment of motion detection and user configuration.

3. Automated device discovery: Enables fast discovery of camera devices using methods such as Universal Plug And Play, Broadcast and IP Range scanning.

4. Smart bulk configuration option: Change settings across multiple devices simultaneously and in a very few clicks.

5. Adaptable application behavior: Guides novice users, while expert users can optimize the application for efficient use.

6. Export/import of system and user configuration data: System backup for reliable system operation and fast system recovery. System cloning for efficient rollout of multiple systems with the same, or similar, configuration.

7. Import of off-line configuration data: Enabling off-line editing of configuration data, including camera and device definitions.

8. Automatic system restore points: A 'Restore Point' is created each time a configuration change is confirmed.

9. Enables easy rollback to previously defined system configuration points and enables cancelation of undesired configuration changes and restoration of earlier valid configurations.

C. Integration Options

1. Open Software Development Kit (SDK) makes it possible to video enable your business processes, through seamless integration of third party applications, such as video analytics, access systems, etc.

2. Compatible with Central for alarm overviews and operational status in larger video surveillance installations.

3. Integrate with physical access control systems, alarms, gates, building management systems, etc. using hardware I/O, internal events and TCP/IP events

4. Create, import and use HTML pages for navigation between views or to trigger a Smart Wall preset

5. Develop third party plug-ins for the Smart Client to expand with new functionality

D. Server Modules

1. Recording Server

a. Simultaneous digital multi-channel video and audio recording and live viewing (relaying).

b. Two-way audio enables integrated control of microphones and speakers connected to IP devices.

c. Bandwidth optimized multi-streaming by splitting a single camera video stream to differentiated streams for live view and recording, where each can be optimized independently with respect to frame rate and resolution.

d. Connectivity to cameras, video encoders and selected NVRS supports H.265.

e. Auto-detect camera models during setup.

2. Flexible multi-site, multi-server license structure charged per camera.

3. Numbered item intentionally left blank

4. Recording technology: secure high speed database holding JPEG images or MPEG4 and MxPEG streams including audio.

5. Recording speed: 30+ frames per second per camera, limited only by hardware.

6. Recording quality depends entirely on camera and video encoder capabilities: no software limitation.

7. Start cameras on live view requests from clients.

8. Unlimited recording capacity with multiple archives possible per day.

9. Hourly to daily database archiving with optional automatic move to network drive saves storage capacity on the local server – with images still available transparently for playback

10. Built-in, real-time, camera independent motion detection (VMD); fully adjustable sensitivity, zone exclusions, recording activation with frame rate speed up, and alert activation through email or SMS.

11. Start recording on event.

12. Client initiated start of recording based on pre-defined recording time and access privileges.

13. Pan Tilt Zoom (PTZ) preset positions, up to 50 per camera.

14. Absolute* and relative PTZ positioning.

15. PTZ go-to preset position on events.

16. Combine PTZ patrolling and go-to positions on events.

17. Set multiple patrolling schedules per camera per day: i.e. different for day/night/weekend.

18. PTZ scanning on supported devices: viewing or recording while moving slowly between PTZ positions.

19. VMD-sensitive PTZ patrolling among selected presets allows sending of Wipe and Wash commands to supported PTZ models.

20. On pre-defined events Matrix remote commands are automatically sent to display live video remotely on computers running the Matrix Monitor or the Smart

21. Client with Matrix Plug-in.

a. Flexible notification (sound, e-mail and SMS) and camera patrolling scheduling, triggered by time or event.

E. Recording Server Manager

1. Local console management of the Recording Server accessible from the notification area.

2. Start and stop Recording Server service.

3. Access to Recording Server configuration settings.

4. Access to Recording Server help system.

5. View system status and log information.

F. Image Server

1. Remote access for Smart and Remote Clients.

2. Built-in web server for download and launch of clients and plug-ins.

3. Set up one Master and multiple Slave Servers.

4. Authenticate access based on Microsoft Active Directory user account, or user name and password.

5. Authorize access privileges per Microsoft Active Directory user account/group, user profile or grant full access.

6. User profiles control access to: Live view, PTZ, PTZ presets, Output control, Events, Listen to microphone, Talk to speaker, Manual recording; Playback, AVI export, JPG export, DB export, Sequences, Smart Search and audio. As well as Set up views, Edit private views and Edit shared public views.

7. Audit logs of exported evidence by user and file.

8. Audit logs of client user activity by time, locations and cameras.

G. Recording Viewer

1. Playback recorded video and audio locally on the

H. Recording Server.

1. View up to 16 cameras time-synched during playback.

2. Scrollable activity timeline with magnifying feature.

3. Instant search on recordings based on date/time and activity/alarm (Video Motion Detection).

4. 'Smart Search' for highlighted image zones and objects.

5. Evidence can be generated as a printed report, a JPEG image, an AVI film or in the native database format.

6. Export audio recordings in WAV or AVI format.

7. Export video digitally zoomed to view area of interest only and to minimize export footprint size.

8. Export 'Evidence CD' containing native database and Recording Viewer for instant, easy viewing by authorities.

9. Encryption & password protection option for exported recordings and files.

10. Ability to add comments to exported evidence, also encrypted.

11. Option to send email.

12. Intentionally left blank

13. IPIX technology for PTZ in 360° recorded images.

I. PDA Server

1. Remote access for PDA Client.

2. Handle login and session requests between PDA clients and Image Server.

3. Resize video surveillance images to fit the screen layout of PDA Client.

J. Smart Client Module

1. Smart Client includes all the features of Remote Client plus more:

2. Installed per default on Recording Server for local viewing and playback of video and audio.

3. Start recording on cameras for a pre-defined time (default 5 minutes). Subject to privileges set by administrator.

4. Independent Playback capability allows for instant playback of recorded video for one or more cameras, while in live and playback mode

5. Live view digital zoom allows zoomed-out recordings while the operator digitally can zoom in to see details.

6. 'Update On Motion Only' optimizes CPU usage by letting motion detection control whether the image should be decoded and displayed or not. The visual effect is a still image in the view until motion is detected.
7. Shared and private camera views offer 1x1 up to 10x10 layouts in addition to asymmetric views.
8. Views optimized for both 4:3 and 16:9 screen ratios.
9. Multiple computer monitor support with a main window and any number of either windowed or full screen views.
10. Hotspot function for working in details with a camera selected from a view containing multiple cameras.
11. Carousel function allows a specified view to rotate between pre-defined cameras with individual timing and order with multiple appearances. Carousel function can be controlled allowing the operator to pause carousel function and to switch to previous or next camera.
12. Overlay buttons provides intuitive control of cameras, camera-integrated devices and other integrated systems- directly from the camera view
13. Matrix function to view live video from multiple cameras through the Image Server in any view layout with customizable rotation path, remotely controlled by Smart
14. Clients or Recording Servers sending Matrix remote commands
15. Send Matrix remote commands to display live video remotely on computers running the Matrix Monitor or the Smart Client with Matrix Plug-in.
16. Cameras' built-in audio sources available in live and in playback.
17. Separate pop-up window displaying sequences and time intervals in thumbnail pre-views, the Sequence Explorer gives unparalleled visual overview of recorded video combined with smooth navigation
18. Presents recorded sequences for individual cameras, or all cameras in a view
19. Seamlessly available in both Live and Playback modes
20. Smooth navigation with sliding preview and "drag-andthrow" function for video thumbnails
21. Instant playback of video sequences
22. Application Options allows users to adapt the layout and personalize the application to their particular preferences

K. Remote Client

1. View live video or playback recordings for 1-16 cameras simultaneously; from the same or different servers.

2. Advanced video navigation including fast/slow playback, jump to date/time, single step and video motion search.
3. Individual views can be user-defined in various layouts: view or playback camera images from multiple servers simultaneously in the same view.
4. Shared views can be managed centrally via the server with admin/user rights and user groups.
5. Import static or active HTML maps for fast navigation to cameras and good premise overviews.
6. Control output port relay operation, for example control of gates.
7. Quick overview of sequences with detected motion and preview window.
8. Quick overview of events/alerts.
9. Control PTZ cameras remotely, also using preset positions.
10. Remote PTZ Point-and-Click control
11. Remote PTZ zoom to a marked rectangle.
12. Take manual control over a PTZ camera that runs a patrolling scheme; after a timeout with no activity the camera reverts to its scheduled patrolling.
13. IPIX 1x2 or 2x2 'Quad View' for viewing all 360° at once.
14. Optional video compression in streaming from server to client gives better use of bandwidth.
15. Create AVI files or save JPEG images.
16. Print incident reports with free-text user comments.
17. System logon using user name and password.
18. System logon using Microsoft Active Directory user accounts.

L. PDA Client

1. View live or playback video from a single server or from multiple servers in half-screen or full-screen formats.
2. In live view you can control Pan/Tilt/Zoom cameras manually or use preset positions, and control the cameras' output relays to trigger external actions like opening doors or gates, turning on lights, etc.
3. To find recordings, you can jump to specific time/date or to next detected motion, or use motion detection sequence overviews.
4. When viewing recordings, you can playback at variable speed or single step image by image.
5. The PDA client shall connect to the VMS server using any IP connection; typically wireless LAN, GPRS, etc.
6. Video compression from the server to PDA optimizes bandwidth usage.
7. System logon using user name and password.

M. Matrix Monitor

1. Virtual Matrix showing live video directly from up to 4 cameras at a time triggered remotely by Matrix remote commands.

2. Camera view shifts by FIFO (first-in-first-out)

3. Multiple events can control a single Matrix monitor and single events can control multiple monitors.

N. Minimum System Requirements VMS Server

R. Licensing Structure

1. Base Server License

a. An VMS Base Server license is mandatory for installing the product.

2. The Base Server license contains:

a. Unlimited numbers of Recording Server licenses

b. Unlimited numbers of Smart Clients, Remote Clients, PDA Clients and Matrix Monitor licenses

3. Camera License

a. To connect to a camera, a Device License per camera channel is required

b. In total, for all copies of the product installed under a given Base Server license, the product may only be used with as many cameras as you have purchased camera licenses for.

c. Camera Licenses can be purchased in any numbers. To extend the installation with additional Camera Licenses, the Base Server License number (SLC) is required when ordering.

4. Client License:

a. All client modules are not licensed and can be installed and used on any number of computers.

S. IP NETWORK DECODER

1. The unit shall be used for video monitoring and surveillance over IP networks. Network decoder shall decode MPEG-4 digital video to HDMI video.

2. The decoder shall use MPEG-4 compression for efficient distribution of images over a network.

3. The decoder shall be available as a standalone unit that can be horizontally or vertically mounted.

4. The decoder shall include, but not be limited to the following:

1) The decoder shall provide one HDMI video input and output connection.

2) The decoder shall provide one Ethernet connection.

d. The decoder shall use the following protocols:

1) TCP/IP

2) UDP/IP

3) DHCP

4) Multicast

5) Data Throttle

6) Heart beat

e. The decoder shall have the following connectors:

1) Power connector: 3-pin male – for connecting the external power supply

2) I/O connector: 16-pin male – for connecting alarm, audio, RS-232, RS-485 input and output

3) Video output connector: HDMI

4) Ethernet port: RJ-45 – for connecting to a network

f. The decoder shall have the following indicators:

1) Power LED

2) Link – indicates activity on the Ethernet port

3) Tx activity

4) Rx activity

5. 4) Audio compression standard: MPEG-1 Layer 2

b. Audio

1) Audio input: 315 mV, 40 kOhms, unbalanced

2) Audio output: 315 mV, 600 ohms, unbalanced

c. Electrical

1) External power supply: 100 to 240 VAC

2) Output voltage: 13.5 V, 1.33 A

3) Power consumption: 0.5 W maximum

2.5 CONTROLLING EQUIPMENT

A. Shall be utilized to call up, operate, and program all cameras associated VSS System components.

B. Will have the ability to operate the cameras locally and remotely. A matrix switcher or a network server shall be utilized as the VSS System controller.

C. The controller shall be able to fit into a standard 47.5 cm (19 inch) equipment rack.

D. Control and programming keyboards shall be provided with its own type of switcher. All keyboards shall:

1. Be located at each monitoring station.

2. Be addressable for programming purposes.

3. Provide interface between the operator and the VSS System.

4. Provide full control and programming of the switcher.

5. Have the minimum following controls:

a. programming

b. switching

c. lens function

d. P/T/Z

e. environmental housing

f. annotation

2.6 VIDEO CAMERAS

A. The cameras shall be high-resolution color video cameras with wide dynamic range capturing capability. *Must be NDAA compliant, manufactured in North America, minimum 5 year warranty, 24/7 Technical Support from the manufacturer at no Charge. Artificial intelligence (AI) and video analytics capabilities, including appearance search and unusual motion detection technology.*

B. The camera shall meet or exceed the following specifications:

1. The image capturing device shall be an image sensor designed for capturing wide dynamic images.

a. The image capturing device shall have a separate analog-to-digital converter for every pixel.

b. The image capturing device shall sample each pixel multiple times per second.

c. The dynamic range shall be 95 dB typical and 120 dB maximum.

2. The camera shall optimize each pixel independently.

3. The camera shall have onscreen display menus for programming of the camera’s settings.

4. The camera shall have IP video output.

5. The camera shall come with a manual varifocal lens.

C.~G. Intentionally left blank

H. Fixed Color Camera

1. The camera shall be a high-resolution color video camera with wide dynamic range capturing capability.

2. Comply with UL 639.

3. Pickup Device: CCD.

4. Signal-to-Noise Ratio: Not less than 50 dB, with the camera AGC off.

5. With AGC, manually selectable on or off.

6. Manually selectable modes for backlight compensation or normal lighting.

7. Scanning Synchronization: Determined by external synch over the UTP cable. Camera shall revert to internally generated synchronization on loss of external synch signal.

8. White Balance: Auto-tracing white balance, with manually selectable fixed balance option.

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10. Fixed color camera shall be enclosed in dome and have board mounted varifocal lens.

11. Camera accessories shall include:

a. Surface mount adapter

b. Wall mount adapter

c. Flush mount adapter

I.~P. Intentionally left blank

Q. Camera accessories shall include:

1. Surface mount adapter

2. Wall mount adapter

3. Flush mount adapter

R. Indoor/Outdoor Dome System (IP)

1. The indoor/outdoor dome system shall include a built-in 100Base-TX network interface for live streaming to a standard Web browser.

2. The network mini dome shall be integrated into the back box design to accept multiple camera options without modification. The network mini dome shall operate in open architecture connectivity for third-party software recording solutions.

3. The indoor/outdoor fixed mini dome system shall meet or exceed the design and performance specifications included in this document.

S. Megapixel High Definition Integrated Digital Network Camera

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2. An alarm input and relay output shall be built in for integration with hard wired external sensors.

3. The network camera shall be capable of firmware upgrades through a network using a software-based device utility.

4. The network camera shall offer auto back focus (ABF) functionality through a push button on the camera. ABF parameters shall also be configurable through a standard Web browser interface.

5. The network camera shall offer a video output port providing an IP video output signal for adjusting field of view and focus at the camera.

6. The network camera shall provide advanced low-light capabilities for color and day/night models with sensitivity down to 0.12 lux in color and 0.03 lux in black-white (B-W).

7. The network camera shall have removable IR cut filter mechanism for increased sensitivity in low-light installations. The sensitivity of IR cut filter removal shall be configurable through a Web browser.

8. The network camera shall support two simultaneous, configurable video streams. H.264 and MJPEG compression formats shall be available for primary and secondary streams with selectable unicast and multicast protocols. The streams shall be configurable in a variety of frame rates and bit rates.

9. The network camera shall support industry standard Power over Ethernet (PoE)

10. IEEE 802.3af to supply power to the camera over the network. The network camera shall also offer a 12 or 24 VDC power input for optional use.

11. The network camera shall use a standard Web browser interface for remote administration and configuration of camera parameters.

12. The network camera shall have a window blanking feature to conceal user-defined privacy areas that cannot be viewed by an operator. The network camera shall support up to four blanked windows. A blanked area shall appear on the screen as a solid gray window.

13. The network camera shall support standard IT protocols.

14. The network camera shall support open architecture best practices with a published API available to third-party network video recording and management systems.

15. Megapixel High Definition Integrated Digital Network Camera Technical Specifications:

The cameras for Medpark Garage shall meet or exceed the following specifications.

Imaging Device	**12mp - fisheye**
Imager Type	1/2.3” progressive scan CMOS
Maximum Resolution	3008 x 3008
Signal-to-Noise Ratio	NA
Auto Iris Lens Type	Fixed iris
Electronic Shutter Range	Automatic, Manual (1/6 to 1/8000 sec)
Wide Dynamic Range	120 dB
White Balance Range	Automatic, Manual

Sensitivity	Lens 1.6 mm IR Illumination Max Distance (high power 850 nm LEDs - 12 m (39 ft) max distance at 0 lux Minimum Illumination - 0.19 lux in monochrome mode; 0.38 lux in color mode
Dome Attenuation	Clear Zero light loss
Compression	H.264 HDSM SmartCodec, H.265 HDSM SmartCodec, Motion JPEG
Video Streams	Multi-stream H.264, Multi-stream H.265, Motion JPEG
Frame Rate	30 Hz/60 Hz): 15 fps/30 fps1
Available Resolutions	Primary Stream - 3008 x 3008 Secondary Stream - 512 x 512; 384 x 384 Tertiary Stream - 320 x 320
Supported Protocols	IPv6, IPv4, HTTP, HTTPS, SOAP, DNS, NTP, RTSP, RTCP, RTP, TCP, UDP, IGMPv2, ICMP, DHCP, Zeroconf, ARP, HSTS
Security Access	Password protection, HTTPS encryption, digest authentication, WS authentication, user access log, 802.1x port based authentication, FIPS 140-2 L1 (with optional camera license), FIPS 140-2 L3 (with optional accessory)
Software Interface	Web browser view and setup.
Connectors	100BASE-TX, RJ45 Connector, CAT5e Cabling
Cable	100BASE-TX, RJ45 Connector, CAT5e Cabling
Input Voltage	VDC: 12 V +/-10%, 11 W min PoE: IEEE 802.3af Class 3
Power Consumption	11 W
Current Consumption	11 W
Alarm Input	NA
Alarm Output	NA
Lens Mount	NA

Operating Temp	-40°Cto+60°C(-40°Fto140°F)

Imaging Device	**Multi-sensor 15mp 180,270 (3x5mp)**
Imager Type	1/2.8" CMOS
Maximum Resolution	7680 x 1440 (16:9)
Signal-to-Noise Ratio	NA
Auto Iris Lens Type	Fixed
Electronic Shutter Range	Automatic, Manual (1/7.5 to 1/8000 sec)
Wide Dynamic Range	120 dB, true WDR, dual exposure
White Balance Range	Automatic, Manual
Sensitivity	0.020 lux (F1.5) in color mode 0.018 lux (F1.5) in mono mode 0 lux with optional IR illuminator
Dome Attenuation	Clear Zero light loss
Compression	H.264 HDSM SmartCodec, H.265 HDSM SmartCodec, Motion JPEG
Video Streams	Multi-stream H.264, Multi-stream H.265, Motion JPEG
Frame Rate	24 / 20 fps -
Available Resolutions	7680 x 1440 (16:9) 7776 x 1944 (4:3)
Supported Protocols	IPv4, IPv6, HTTP, HTTPS, SOAP, DNS, NTP, RTSP, RTCP, RTP, TCP, UDP, IGMPv2, ICMP, DHCP, Zeroconf, ARP, HSTS
Security Access	Signed and encrypted firmware, password protection, HTTPS encryption, digest authentication, WS authentication, user access log, 802.1x port based authentication, TLS1.3, FIPS140-2 Level 3 via onboard TPM
Software Interface	Web browser view and setup.
Connectors	RJ-45
Cable	Cat5E
Input Voltage	With IR: 52 W with 24 VDC 74 VA with 24 VAC 51 W with high power PoE (PoE++) Without IR: 26 W with 24 VDC 37 VA with 24 VAC 25.5 W with IEEE 802.3at Type 2

	(PoE+)
Power Consumption	With IR: 52 W with 24 VDC 74 VA with 24 VAC 51 W with high power PoE (PoE++) Without IR: 26 W with 24 VDC 37 VA with 24 VAC 25.5 W with IEEE 802.3at Type 2 (PoE+)
Current Consumption	With IR: 52 W with 24 VDC 74 VA with 24 VAC 51 W with high power PoE (PoE++) Without IR: 26 W with 24 VDC 37 VA with 24 VAC 25.5 W with IEEE 802.3at Type 2 (PoE+)
Alarm Input	Line level input and output
Alarm Output	Line level input and output
Lens Mount	Fixed Iris, Remote Focus and Zoom
Pan/Tilt Adjustment	53° - 97° (16:9) 53° - 99° (4:3)
Imaging Device	1/2.8” CMOS
Imager Type	1/2.8” CMOS
Maximum Resolution	7680 x 1440 (16:9)
Signal-to-Noise Ratio	NA
Auto Iris Lens Type	Fixed
Electronic Shutter Range	Automatic, Manual (1/7.5 to 1/8000 sec)
Wide Dynamic Range	120 dB, true WDR, dual exposure
White Balance Range	Automatic, Manual
Sensitivity	0.020 lux (F1.5) in color mode 0.018 lux (F1.5) in mono mode 0 lux with optional IR illuminator
Dome Attenuation	Clear Zero light loss
Compression	H.264 HDSM SmartCodec, H.265 HDSM SmartCodec, Motion JPEG
Video Streams	Multi-stream H.264, Multi-stream H.265, Motion JPEG
Frame Rate	30 / 25 fps
Available Resolutions	7680 x 1440 (16:9) 7776 x 1944 (4:3)

Supported Protocols	IPv4, IPv6, HTTP, HTTPS, SOAP, DNS, NTP, RTSP, RTCP, RTP, TCP, UDP, IGMPv2, ICMP, DHCP, Zeroconf, ARP, HSTS
Security Access	Signed and encrypted firmware, password protection, HTTPS encryption, digest authentication, WS authentication, user access log, 802.1x port based authentication, TLS1.3, FIPS140-2 Level 3 via onboard TPM
Software Interface	Web browser view and setup
Connectors	RJ-45
Cable	Cat5E
Input Voltage	24 VDC ± 10 %; 24 VAC rms ± 10 %, 50 or 60 Hz
Power Consumption	With IR: 52 W with 24 VDC 74 VA with 24 VAC 51 W with high power PoE (PoE++) Without IR: 26 W with 24 VDC 37 VA with 24 VAC 25.5 W with IEEE 802.3at Type 2 (PoE+)
Current Consumption	With IR: 52 W with 24 VDC 74 VA with 24 VAC 51 W with high power PoE (PoE++) Without IR: 26 W with 24 VDC 37 VA with 24 VAC 25.5 W with IEEE 802.3at Type 2 (PoE+)
Alarm Input	Alarm In, Alarm Out
Alarm Output	Alarm In, Alarm Out
Pan/Tilt Adjustment	53° - 97° (16:9) 53° - 99° (4:3)
Operating temp	-40°Cto+60°C(-40°Fto140°F)

Imaging Device	**Multi-sensor 20mp (4x5mp) 360**
Imager Type	1/2.8” CMOS
Maximum Resolution	10240 x 1440 (16:9)
Signal-to-Noise Ratio	NA
Auto Iris Lens Type	Fixed

Electronic Shutter Range	Automatic, Manual (1/7.5 to 1/8000 sec)
Wide Dynamic Range	120 dB, true WDR, dual exposure
White Balance Range	Automatic, Manual
Sensitivity	0.020 lux (F1.5) in color mode 0.018 lux (F1.5) in mono mode 0 lux with optional IR illuminator
Dome Attenuation	Clear Zero light loss
Compression	H.264 HDSM SmartCodec, H.265 HDSM SmartCodec, Motion JPEG
Video Streams	Multi-stream H.264, Multi-stream H.265, Motion JPEG
Frame Rate	30 / 25 fps
Available Resolutions	10240 x 1440 (16:9) 10368 x 1944 (4:3)
Supported Protocols	IPv4, IPv6, HTTP, HTTPS, SOAP, DNS, NTP, RTSP, RTCP, RTP, TCP, UDP, IGMPv2, ICMP, DHCP, Zeroconf, ARP, HSTS
Security Access	Signed and encrypted firmware, password protection, HTTPS encryption, digest authentication, WS authentication, user access log, 802.1x port based authentication, TLS1.3, FIPS140-2 Level 3 via onboard TPM
Software Interface	Web browser view and setup
Connectors	RJ-45
Cable	Cat5E
Input Voltage	24 VDC ± 10 %; 24 VAC rms ± 10 %, 50 or 60 Hz
Power Consumption	With IR: 52 W with 24 VDC 74 VA with 24 VAC 51 W with high power PoE (PoE++) Without IR: 26 W with 24 VDC 37 VA with 24 VAC 25.5 W with IEEE 802.3at Type 2 (PoE+)
Current Consumption	With IR: 52 W with 24 VDC 74 VA with 24 VAC 51 W with high power PoE (PoE++) Without IR: 26 W with 24 VDC 37 VA with 24 VAC

	25.5 W with IEEE 802.3at Type 2 (PoE+)
Alarm Input	Alarm In, Alarm Out
Alarm Output	Alarm In, Alarm Out
Lens Mount	Fixed Iris, Remote Focus and Zoom
Pan/Tilt Adjustment	53° - 97° (16:9) 53° - 99° (4:3)
Operating temp	-40°Cto+60°C(-40°Fto140°F)

Imaging Device	**Multi-sensor 32mp (4x8mp) 360**
Wide dynamic range (WDR)	3.3mm - 5.7mm lens
Image Sensors	1/2.8 inch progressive scan CMOS.
Active pixels	3840 x 2160 (16:9) 2880 x 2160 (4:3)
Field of View:	Aspect Ratio: 4:3. a)Horizontal: 43 degrees to 74 degrees per sensor; up to 270 degrees combined. b)Vertical: 32 degrees to 55 degrees per sensor. Aspect Ratio: 16:9. a)Horizontal: 58 degrees to 106 degrees per sensor; up to 270 degrees combined. b)Vertical: 32 degrees to 55 degrees per sensor.
Active Pixels (H x V):	3840 x 2160 per sensor. 1) 3840 x 2160 per sensor.With WDR on: 17 fps at 60Hz and 16 fps at 50Hz. 2) With WDR off: 20 fps at 60Hz and 20 fps at 50Hz.
IR Illumination:	Color Mode: 0.02 lux (F1.5). Mono Mode 0.016 lux (F1.5).
Dynamic Range	120 dB with WDR active.
Operating temp	-40°Cto+60°C(-40°Fto140°F)

Imaging Device	**4mp bullet**
Imager Type	1/1.8” progressive scan CMOS

Maximum Resolution	(16:9) 3328 x 1872, 3200
Signal-to-Noise Ratio	NA
Auto Iris Lens Type	Remote Zoom and Focus, Autofocus, IR Cut Filter
Electronic Shutter Range	Automatic, Manual (1/7.5 to 1/15000 sec)
Wide Dynamic Range	Up to 106dB (dual exposure, 30 fps) Up to 136dB (triple exposure, 20 fps or less)
White Balance Range	Automatic, Manual
Sensitivity	With IR: 0 lux in monochrome mode Without IR: 0.003 lux in monochrome mode; 0.008 lux in color mode
Dome Attenuation	Clear Zero light loss
Compression	H.264 HDSM SmartCodec, H.265 HDSM SmartCodec, Motion JPEG
Video Streams	Multi-stream H.264, Multi-stream H.265, Motion JPEG
Frame Rate	(50 Hz/60 Hz): 50 fps/60 fps in High Frame Rate Mode2, otherwise 25 fps/30 fps
Available Resolutions	(16:9) 2688 x 1520, 2560 x 1440, 1920 x 1080 (4:3) 1984 x 1488
Supported Protocols	IPv6, IPv4, HTTP, HTTPS, SOAP, DNS, NTP, RTSP, RTCP, RTP, TCP, UDP, IGMP, ICMP, DHCP, Zeroconf, ARP, HSTS
Security Access	Password protection, HTTPS encryption, digest authentication, WS authentication, user access log, 802.1x port based authentication, FIPS 140-2 L1 (with optional camera license), onboard FIPS 140-2 L3 certified TPM, Secure Boot
Software Interface	Web browser view and setup
Connectors	RJ-45
Cable	Cat5E
Input Voltage	12-24 VDC +/-10%
Power Consumption	25W Max
Current Consumption	IEEE 802.3at Class 4

Alarm Input	1 x Relay In, 1 x Relay Out, 1 x 12 VDC out at 50 mA
Alarm Output	1 x Relay In, 1 x Relay Out, 1 x 12 VDC out at 50 mA
Lens Mount	Remote Zoom and Focus, Autofocus, IR Cut Filter
Pan/Tilt Adjustment	(16:9) 26° – 57° (4:3) 26° – 57°
Operating temp	-40°Cto+60°C(-40°Fto140°F)

Imaging Device	**License Plate Capture**
Maximum capture speed	100km/h, 62mph
Operating temp	-22 deg. F to 122 deg F
Minimum illumination	O lux
IR illumination	850nm, continuous, field adjustable angle
Maximum IR Illumination Distance	Single Lane: 30m (100ft), Dual Lane: 14m (46ft)
Cold Start Delay	Up to 1.5 hours
Humidity	0 - 95% non-condensing
Image Sensor	1/2.8” progressive scan CMOS
Aspect Ratio	4:3
Active Pixels	3MP: 2048 x 1536
Imaging Area	5.12 mm x 3.84 mm; 0.20” x 0.15”
Maximum Image Rate	30 fps
Lens	4.7 – 84.6mm, F1.6, P-Iris, remote focus and zoom
Angle of View	3.5° – 59°
Flicker Control	50 Hz, 60 Hz
Network	100BASE-TX
Certifications	UL, cUL, CE, ROHS, WEEE, RCM
Safety	UL 60950-1, CSA 60950-1, IEC/EN 60950-1
Electromagnetic Emissions	FCC Part 15 Subpart B Class B, IC ICES-003 Class B, EN 55032 Class B, EN 61000-6-3, EN 61000-3-2, EN 61000-3-3
Electromagnetic Immunity	EN 61000-6-1
Enclosure	Adhere to manufacturers recommendation.

IR illuminator	Adhere to manufacturers recommendation

Imaging Device	**Dual head camera**
Image sensor	1/(2.7”) progressive scan CMOS
Max Resolution(HxV) and Aspect Ratio	(4:3)2048x1536
Operating Temperature	30°Cto+60°C(-22°Fto140°F),inenclosedspace-30°Cto+65°C(-22°Fto149°F),with ambient convection
Max Image Rate(60 Hz/50Hz)	Analytics 24/25fps
Frame rate	High Frame rate mode 30/25fps
Lens	3.35-7.0mm,F/1.93remotefocusandzoom,fixediris
IRIlluminationMax Distance2(high power 850nmLEDs)	Wide:15m(49ft) Tele:30m(98ft)
Minimum Illumination	0.1luxincolormode,0.05luxinmonochromemode,0luxwithIRon
Horizontal Angle of View	43°-91°
Vertical Angle of View	32°-67°
Network	100BASE-TX,RJ45Connector
IR Illuminator Behavior	IRilluminatorwillturnoffifthetemperatureis55°C(131°F)orhigher.Theilluminatorwilloperateat50%powerifthe temperatureisbetween45°C(113°F)and54°C(129°F). Theilluminatorwilloperateat50%powerifthetemperatureisbelow-25°C(-13°F),withambientconvection.
Humidity	0-95% non-condensing
Certifications/Directives	UL,cUL,CE,UKCA,ROHS,REACH,RCM,KC,EAC,BIS,NOM
Safety	UL62368-1,CSA62368-1,IEC/EN62368-1,IEC62471
Environmental	UL/CSA/IEC60950-22,IEC62262IK10ImpactRating IEC60529IP66andIP67WeatherRating(H5DH-DO1-IRmodelsonly)

Imaging Device	**2mp dome**
Imager Type	1/2.8” progressive scan CMOS
Maximum Resolution	(16:9) 1920 x 1080
Signal-to-Noise Ratio	NA

Auto Iris Lens Type	Remote Zoom and Focus, Autofocus, IR Cut Filter
Electronic Shutter Range	Automatic, Manual (1/7.5 to 1/15000 sec)
Wide Dynamic Range	Up to 126 dB (dual exposure, 30 fps) Up to 144 dB (triple exposure, 20 fps or less)
White Balance Range	Automatic, Manual
Sensitivity	With IR: 0 lux in monochrome mode Without IR: 0.003 lux in monochrome mode; 0.01 lux in color mode
Dome Attenuation	Clear Zero light loss
Compression	H.264 HDSM SmartCodec, H.265 HDSM SmartCodec, Motion JPEG
Video Streams	Multi-stream H.264, Multi-stream H.265, Motion JPEG
Frame Rate	(50 Hz/60 Hz): 50 fps/60 fps in High Frame Rate Mode1, otherwise 25 fps/30 fps
Available Resolutions	(16:9) 1920 x 1080 (16:9) 1920 x 1080*, 1280 x 720, 768 x 432, 640 x 360, 512 x 288
Supported Protocols	IPv6, IPv4, HTTP, HTTPS, SOAP, DNS, NTP, RTSP, RTCP, RTP, TCP, UDP, IGMP, ICMP, DHCP, Zeroconf, ARP, HSTS
Security Access	Password protection, HTTPS encryption, digest authentication, WS authentication, user access log, 802.1x port based authentication, FIPS 140-2 L1 (with optional camera license), onboard FIPS 140-2 L3 certified TPM, Secure Boot
Software Interface	Web browser view and setup
Connectors	RJ-45
Input Voltage	12-24 VDC +/-10%
Power Consumption	25W (18W with no IR or IR disabled)
Current Consumption	25W (18W with no IR or IR disabled)

Alarm Input	1 x Relay In, 1 x Relay Out, 1 x 12 VDC out at 50 mA
Alarm Output	1 x Relay In, 1 x Relay Out, 1 x 12 VDC out at 50 mA
Lens Mount	Remote Zoom and Focus, Autofocus, IR Cut Filter
Pan/Tilt Adjustment	(16:9) 27° – 119°
Operating temp	-40°Cto+60°C(-40°Fto140°F)

Imaging Device	**2 MP Dome with audio analytics**
Image Sensor	1/2.8" progressive scan CMOS
Max Resolution (H x V) and Aspect Ratio	Primary (16:9) 1920 x 1080
	Secondary (16:9) 1920 x 1080*, 1280 x 720, 768 x 432, 640 x 360, 512 x 288
	Tertiary (16:9) 1280 x 720, 768 x 432, 640 x 360, 512 x 288, 384 x 216
Dynamic Range	WDR Off - Up to 83 dB
	WDR On (IEC 62676) - Up to 126 dB (dual exposure, 30 fps) Up to 144 dB (triple exposure, 20 fps or less)
	WDR On - Up to 130 dB (dual exposure, 30 fps) Up to 150 dB (triple exposure, 20 fps or less)
Max Image Rate	(50 Hz/60 Hz): 50 fps/60 fps in High Frame Rate Mode1, otherwise 25 fps/30 fps
Network	100BASE-TX for H6A, 1000BASE-T for H6X
Operating Temperature	-30°C to +65°C (-22°F to 140°F) with IEEE 802.3af Class 3 (13W PoE)
Humidity	0 - 95% non-condensing
Certifications/Approvals	UL, cUL, CE, ROHS, RCM, UKCA, NOM, KC, BIS
Safety Standards	UL 62368-1, CSA 62368-1, IEC/EN 62368-1, IEC 62471, UL 2043 Plenum (in-ceiling only)

Environmental Standards/Ratings	IEC 60529 IP66, IP67, IP68 (2m depth for 2 hours), IPX9K, NEMA 4X, IEC 60068-2 Shock & Vibration, NEMA TS2 Sec 2.2.7-2.2.9, IK11
Electromagnetic Emissions Standards	FCC Part 15 Subpart B Class B, ICES-003 Class B, EN 55032 Class B, EN 61000-6-3, EN 61000-3-2, EN 61000-3-3, EN 50121-4, EN 50130-4
SUPPORTED AUDIO ANALYTICS EVENTS	
Gunshot	Up to 100 meters
Scream	Up to 15 meters
Glass Break	Up to 15 meters

16. Accessories

a. Pendant mount

b. Wall mount for pendant

c. Corner adapter for wall mount

d. Pole adapter for wall mount

17. Recommended Lenses

a. Megapixel lens, varifocal, 2.2~6.0 mm, f/1.3~2.0

b. Megapixel lens, varifocal, 2.8~8.0 mm,f/1.1~1.9

c. Megapixel lens, varifocal, 2.8~12.0 mm, f/1.4~2.7

d. Megapixel lens, varifocal, 15.0~50.0 mm, f/1.5~2.1

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Y. NETWORK CAMERAS

1. Shall be IEEE 802.3af compliant.

a. Shall be utilized for interior and exterior purposes.

b. *A Category CAT6A, OSP rated, with 15 year warranty, cable will be the primary source for carrying signals from a switch hub or network server. If any camera is installed greater than 100 m (300 ft.) from the controlling device then the following will be required:*

1) A local or remote 12 or 24 VDC power source will be required from a Class 2, UL compliant power supply.

2) A signal converter will be required to convert from a > Cat6A cable over to a fiber optic or standard signal cable. The signal will need to be converted back to a CAT6A cable at the controlling device using a signal converter card.

c. Shall be routed to a controlling device via a network switch.

d. Shall be a programmable IP address that allows for installation of multiple units in the same Local Area Network (LAN) environment.

e. Incorporate a minimum of Transmission Control Protocol (TCP)/IP, User Datagram Protocol (UDP), Hypertext Transfer Protocol (HTTP), File Transfer Protocol (FTP), Internet Control Message Protocol (ICMP0, Address Resolution Protocol (ARP), Real-Time Transport Protocol (RTP), Dynamic Host Configuration Protocol (DHCP), Network Time Protocol (NTP), Simple Mail Transfer Protocol (SMTP), Internet Group Management Protocol (IGMP), and Differentiated Service Code Point (DSCP) protocols for various network applications.

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BB. LENSES

1. Camera Field of View shall be set by the Contractor to produce full view of door or window opening and anyone entering or leaving through it. Follow the project construction drawings for design intent.

2. Camera Lenses shall be of the type supplied with the camera from the manufacture. All cameras which are not supplied with lenses from the factory are specified in this specification. The lens shall be equipped with an auto-iris mechanism unless otherwise specified. Lenses having auto-iris, DC iris, or motor zoom functions shall be supplied with connectors, wiring, receiver/drivers, and controls as needed to operate the lens functions. Lenses shall have sufficient circle of illumination to cover the image sensor evenly. Lenses shall not be used on a camera with an image format larger than the lens is designed to cover. Lenses shall be provided with pre-set capability.

3. Lenses shall have optical-quality coated optics, designed specifically for video surveillance applications, and matched to specified camera. Provide color-corrected lenses with color cameras, megapixel lenses for megapixel cameras, and lenses with day/night for color/b&w cameras.

4. Auto-Iris Lens: Electrically controlled iris with circuit set to maintain a constant video level in varying lighting conditions.

5. Zoom Lenses: Motorized, remote-controlled units, rated as "quiet operating." Features include the following:

a. Electrical Leads: Filtered to minimize video signal interference.

b. Motor Speed: Variable.

c. Lens shall be available with preset positioning capability to recall the position of specific scenes.

6. Lenses: Shall be utilized in a manner that provides maximum coverage of the area being monitored by the camera. The lenses shall:

a. Be 1/3” to fit CCD fixed camera.

b. Be all glass with coated optics.

c. Have mounts that are compatible with the camera selected.

d. Be packaged and supplied with the camera.

e. Have a maximum f-stop of f/1.3 for fixed lenses, and a maximum f-stop of f/1.6 for variable focus lenses.

f. Be equipped with an auto-iris mechanism.

g. Have sufficient circle of illumination to cover the image sensor evenly.

h. Not be used on a camera with an image format larger than the lens is designed to cover.

i. Be provided with pre-set capability.

7. Two types of lenses shall be utilized for both interior and exterior fixed cameras:

a. Manual Variable Focus

b. Auto Iris Fixed

8. Manual Variable Focus:

a. Shall be utilized in large areas that are being monitored by the camera. Examples of this are perimeter fence lines, vehicle entry points, parking areas, etc.

b. Shall allow for setting virtually any angle of field, which maximizes surveillance effects.

c. Technical Characteristics:

Image format	1/3 inch
Focal length	5–50mm
Iris range	F1.4 to close
Focus range	1m (3.3 ft)
Back focus distance	10.05 mm (0.4 in)
Angle view Wide (1/3 in)	53.4 x 40.1
Angle view Tele (1/3 in)	5.3 x 4.1
Iris control	manual
Focus ctrl	manual
Zoom ctrl	manual

CC. CAMERA HOUSINGS AND MOUNTS

1. This section pertains to all interior and exterior housings, domes, and applicable wall, ceiling, corner, pole, and rooftop mounts associated with the housing. Housings and mounts shall be specified in accordance to the type of cameras used.

2. All cameras and lenses shall be enclosed in a tamper resistant housing. Any additional mounting hardware required to install the camera housing at its specified location shall be provided along with the housing.

3. The camera and lens contained inside the housing shall be installed on a camera mount. All additional mounting hardware required to install the camera housing at its specified location shall be provided along with the housing.

4. Shall be manufactured in a manner that are capable of supporting a maximum of three (3) cameras with housings, and meet environmental requirements for the geographical area the camera support equipment is being installed on or within.

5. Environmentally Sealed

a. Shall be designed in manner that it provides a condensation free environment for correct camera operation.

b. Shall be operated in a 100 percent condensing humidity atmosphere.

c. Shall be constructed in a manner that:

1) Has a fill valve to allow for the introduction of nitrogen into the housing to eliminate existing atmospheric air and pressurize the housing to create moisture free conditions.

2) Has an overpressure valve to prevent damage to the housing in the event of over pressurization.

3) Is equipped with a humidity indicator that is visible to the eye to ensure correct atmospheric conditions at all times.

4) The leak rate of the housing is not to be greater than 13.8kPa or 2 pounds per square inch at sea level within a 90 day period.

5) It shall contain camera mounts or supports as needed to allow for correct positioning of the camera and lens.

6) The housing and sunshield are to be white in color.

6. All electrical and signal cables required for correct operations shall be supplied in a hardened carrier system from the controller to the camera.

7. The mounting bracket shall be adjustable to allow for the housing weight of the camera and the housing unit it is placed in.

8. Accessibility to the camera and mounts shall be taken into consideration for maintenance and service purposes.

DD. Indoor Mounts

1. Ceiling Mounts:

a. This enclosure and mount shall be installed in a finished or suspended ceiling.

b. The enclosure and mount shall be fastened to the finished ceiling, and shall not depend on the ceiling tile grid for complete support.

c. Suspended ceiling mounts shall be low profile, and shall be suitable for replacement of 610mm x 610mm (2 foot by 2 foot) ceiling tiles.

2. Wall Mounts:

a. The enclosure shall be installed in manner that it matches the existing décor and placed at a height that it will be unobtrusive, unable to cause personal harm, and prevents tampering and vandalism.

b. The mount shall contain a manual pan/tilt head that will provide 360 degrees of horizontal and vertical positioning from a horizontal position, and has a locking bar or screw to maintain its fixed position once it has been adjusted.

EE. Interior Domes

1. The interior dome shall be a pendant mount, pole mount, ceiling mount, surface mount, or corner mounted equipment.

2. The lower portion of the dome that provides camera viewing shall be made of black opaque acrylic and shall have a light attenuation factor of no more that 1 f-stop.

3. If required, the housing shall be equipped with integral pan/tilt capabilities complete with wiring, wiring harness, connectors, receiver/driver, pan/tilt control system, pre-position cards, or any other hardware and equipment as needed to fully provide a fully functional pan/tilt dome.

4. The pan/tilt mechanism shall be:

a. Constructed of heavy duty bearings and hardened steel gears.

b. Permanently lubricated to ensure smooth and consistent movement of all parts throughout the life of the product.

c. Equipped with motors that are thermally or impedance protected against overload damage.

d. Pan movements shall be 360 degrees and tilt movement shall no be less than +/- 90 degrees.

e. Pan speed shall be a minimum of 10 degrees per second.

FF. Exterior Domes

1. The exterior dome shall meet all requirements outlined in the interior dome paragraph above.

2. The housing shall be constructed to be dust and water tight, and fully operational in 100 percent condensing humidity.

GG. Exterior Wall Mounts

1. Shall have an adjustable head for mounting the camera.

2. Shall be constructed of aluminum, stainless steel, or steel with a corrosion-resistant finish.

3. The head shall be adjustable for not less than plus and minus 90 degrees of pan, and not less than plus and minus 45 degrees of tilt. If the bracket is to be used in conjunction with a pan/tilt, the bracket shall be supplied without the adjustable mounting head, and shall have a bolt-hole pattern to match the pan/tilt base.

4. Shall be installed at a height that allows for maximum coverage of the area being monitored.

HH. Explosion Proof Housing

1. This housing shall meet or exceed all requirements of NEMA four (4) standards for hazardous locations.

2. It shall be supplied with the mounting brackets for the specified camera and lens.

2.8 POWER SUPPLIES

A. Power supplies shall be a low-voltage power supplies matched for voltage and current requirements of cameras and accessories, type as recommended by camera and lens manufacturer.

B. Technical specifications:

1. Input: 115VAC, 50/60Hz, 2.7 amps

2. Outputs:

a. Number of outputs, 16

b. Fuse/PTC protected, power limited

c. Output voltage & power:

1) 12 or 24 VDC @ 12.4 amp supply current

3. Illuminated power disconnect circuit breaker with manual reset

4. Surge suppression

5. Camera synchronization

6. Wall mount.

7. Enclosure: NEMA 250, Type 4X.

2.9 INFRARED ILLUMINATORS

A. Lighting fixtures that emit light only in the infrared spectrum, suitable for use with cameras indicated, for nighttime surveillance, without emitting visible light.

1. Field-Selectable Beam Patterns: Narrow, medium, and wide.
2. Rated Lamp Life: More than 8000 hours
3. Power Supply: As indicated in the camera specifciations

B. Area Coverage: Illumination to 50 m (150 feet) in a narrow beam pattern.

C. Exterior housings shall be suitable for same environmental conditions as associated camera.

C. All DVR's and NVR's that are viewable over an Intranet or Internet will be routed through an encryptor.

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2.11 ENCRYPTOR

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D. Encryptors shall:

1. Comply with FIPS PUB 140-2.
2. Support TCP/IP.
3. Directly interfaces to low-cost commercial routers.
4. Provide packet-based crypto synchronization.
5. Encrypt source and destination IP addresses.
6. Support web browser based management requiring no additional software.
7. Have a high data sustained throughput — 1.544 Mbps (T1) full duplex data rate.
8. Provide for both bridging and routing network architecture support.
9. Support Electronic Key Management System (EKMS) compatible.
10. Have remote management ability.
11. Automatically reconfigure when secure network or wide area network changes.

2.12 WIRES AND CABLES

A. Shall meet or exceed the manufactures recommendation for power and signal.

B. Will 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.

C. 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.

D. All conduit, pull boxes, and junction boxes shall be clearly marked with colored permanent tape or paint that will allow it to be distinguished from all other conduit and infrastructure.

E. Conduit fills shall not exceed 50 percent unless otherwise documented.

F. A pull string shall be pulled along and provided with signal and power cables to assist in future installations.

G. 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

H. 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 system shall be defined as any cable or sets of cables carrying 30 VDC/VAC or higher.

I. For all equipment that is carrying digital data between the Physical Access Control System and Database Management or at a remote monitoring station, 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.

J. All cables and conductors, except fiber optic cables, that act as a control, communication, or signal lines shall include surge protection. Surge protection shall be furnished at the equipment end and additional triple electrode gas surge protectors rated for the application on each wire line circuit shall be installed within 1 m. (3 ft.) of the building cable entrance. The inputs and outputs shall be tested in both normal and common mode using the following wave forms:

1. A 10 microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 watts and peak current of 60 amperes.

2. An 8 microsecond rise time by 20 microsecond pulse width wave form with a peak voltage of 1000 volts and peak current of 500 amperes.

K. The surge suppression device shall not attenuate or reduce the video or sync signal under normal conditions. Fuses and relays shall not be used as a means of surge protection.

L. Fiber Optic Cables Technical Characteristics:

Fiber Type	62.5 Micron
Number of Fibers	4
Core Diameter 6	2.5 +/- 2.5 microns
Core Non-Circularity	5% Maximum
Clad Diameter	125 +/- 2 microns
Clad Non-Circularity	1% Maximum
Core-clad Offset	1.5 Microns Maximum
Primary Coating Material	Acrylate
Primary Coating Diameter	245 +/- 10 microns
Secondary Coating Material	Engineering Thermoplastic
Secondary Coating Diameter	900 +/- 50 microns
Strength Member Material	Aramid Yarn
Outer Jacket Material	PVC
Outer Jacket Color	Orange
Overall Diameter	.200 in.
Numerical Aperture	.275
Maximum Gigabit Ethernet	550 meters

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11. Power Cables

a. Will be sized accordingly and shall comply with the NEC. High voltage power cables will be a minimum of three conductors, 14 AWG, stranded, and coated with a non-conductive polyvinylchloride (PVC) jacket. Low voltage cables will be a minimum of 18 AWG, stranded and non-conductive polyvinylchloride (PVC) jacket.

b. Will be utilized for all components of the VSS System that require either a 110 VAC 60 Hz or 220 VAC 50 Hz input. Each feed will be connected to a dedicated circuit breaker at a power panel that is primarily for the security system.

c. All equipment connected to AC power shall be protected from surges. Equipment protection shall withstand surge test waveforms described in IEEE C62.41. Fuses shall not be used as a means of surge protection.

d. Shall be rated for either 110 or 220 VAC, 50 or 60 Hz, and shall comply with VA Master Spec 26 05 21 Low Voltage Electrical Power Conductors and Cables (600 Volts and Below).

e. Low Voltage Power Cables

1) Shall be a minimum of 18 AWG, Stranded and have a polyvinylchloride outer jacket.

2) Cable size shall determined using a basic voltage over distance calculation and shall comply with the NEC's requirements for low voltage cables.

PART 3 - EXECUTION

3.1. GENERAL

A. Installation: The Contractor shall install all system components including Owner furnished equipment, and appurtenances in accordance with the manufacturer's instructions, ANSI C2 and as shown, and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable data transmission system.

B. Identification and Labeling: The Contractor shall supply permanent identification labels for each cable at each end that will appear on the as-built drawings. The labeling format shall be identified and a complete record shall be provided to the Owner with the final documentation. Each cable shall be identified by type or signal being carried and termination points. The labels shall be printed on letter size label sheets that are self laminated vinyl that can be printed from a computer data base or spread sheet. The labels shall be E-Z code WES12112 or equivalent.

1. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing.

C. Transient Voltage Surge Suppressors (TVSS): The Contractor shall mount TVSS within 3 m (118 in) of equipment to be protected inside terminal cabinets or suitable NEMA 1 enclosures. Terminate off-premise conductors on input side of device. Connect the output side of the device to the equipment to be protected. Connect ground lug to a low impedance earth ground (less than 10 ohms) via Number 12 AWG insulated, stranded copper conductor.

D. Contractor's Field Test: The Contractor shall verify the complete operation of the data transmission system during the Contractor's Field Testing. Field test shall include a bit error rate test. The Contractor shall perform the test by sending a minimum of 1,000,000 bits of data on each DTM circuit and measuring the bit error rate. The bit error rate shall not

be greater than one (1) bit out of each 100,000 bits sent for each dial-up DTM circuit, and one (1) bit out of 1,000,000 bits sent for each leased or private DTM circuit. The Contractor shall submit a report containing results of the field test.

E. Acceptance Test and Endurance Test: The wire line data transmission system shall be tested as a part of the completed IDS and EECS during the Acceptance test and Endurance Test as specified.

F. Identification and Labeling: The Contractor shall supply identification tags or labels for each cable. Cable shall be labeled at both end points and at intermediate hand holes, manholes, and junction boxes. The labeling format shall be identified and a complete record shall be provided to the Owner with the final documentation. Each cable shall be identified with type of signal being carried and termination points.

3.2 INSTALLATION

A. System installation shall be in accordance with NECA 303, manufacturer and related documents and references, for each type of security subsystem designed, engineered and installed.

B. Components shall be configured with appropriate “service points” to pinpoint system trouble in less than 30 minutes.

C. The Contractor shall install all system components including Government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, documentation listed in Sections 1.5 of this document, and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.

D. The VSS System will be designed, engineered, installed, and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the system is a stand alone or a complete network.

E. For integration purposes, the VSS System shall be integrated where appropriate with the following associated security subsystems:

1. PACS:

a. Provide 24 hour coverage of all entry points to the perimeter and agency buildings, as well as all emergency exits utilizing a fixed color camera.

b. Record cameras on a 24 hours basis.

c. Be programmed go into an alarm state when an emergency exit is opened, and notify the Physical Access Control System and Database Management of an alarm event.

2. IDS:

a. Provide a recorded alarm event via a color camera that is connected to the IDS system by either direct hardwire or a security system computer network.

b. Record cameras on a 24 hours basis.

c. Be programmed to go into an alarm state when an IDS device is put into an alarm state, and notify the PACS.

d. For additional VSS System requirements as they relate to the IDS, refer to Section 28 16 00 “INTRUSION DETECTION”.

3. Security Access Detection:

a. Provide full coverage of all vehicle and lobby entrance screening areas utilizing a fixed color camera.

b. Record cameras on a 24 hours basis.

c. The VSS System should have the capability to support facial recognition software to assist in identifying individuals for current and future purposes.

4. EPPS:

a. Provide a recorded alarm event via a color camera that is connected to the EPPS system by either direct hardwire or a security system computer network.

b. Record cameras on a 24 hours basis.

c. Be programmed to go into an alarm state when an emergency call box or duress alarm/panic device is activated, and notify the Physical Access Control System and Database Management of an alarm event.

F. Integration with these security subsystems shall be achieved by computer programming or the direct hardwiring of the systems.

G. For programming purposes refer to the manufacturers requirements for correct system operations. Ensure computers being utilized for system integration meet or exceed the minimum system requirements outlined on the systems software packages.

H. A complete VSS System shall be comprised of, but not limited to, the following components:

1. Cameras

2. Lenses

3. Video Display Equipment

4. Camera Housings and Mounts

5. Controlling Equipment

6. Recording Devices

7. Wiring and Cables

I. The Contractor shall visit the site and verify that site conditions are in agreement/compliance with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system to the Contracting Officer in the form of a report. The Contractor shall not take any corrective action without written permission received from the Contracting Officer.

J. Existing Equipment

1. The Contractor shall connect to and utilize existing video equipment, video and control signal transmission lines, and devices as outlined in the design package. Video equipment and signal lines that are usable in their original configuration without modification may be reused with Contracting Officer approval.

2. The Contractor shall perform a field survey, including testing and inspection of all existing video equipment and signal lines intended to be incorporated into the VSS System, and furnish a report to the Contracting Officer as part of the site survey report. For those items considered nonfunctioning, provide (with the report) specification sheets, or written functional requirements to support the findings and the estimated cost to correct the deficiency. As part of the report, the Contractor shall include a schedule for connection to all existing equipment.

3. The Contractor shall make written requests and obtain approval prior to disconnecting any signal lines and equipment, and creating equipment downtime. Such work shall proceed only after receiving Contracting Officer approval of these requests. If any device fails after the Contractor has commenced work on that device, signal or control line, the Contractor shall diagnose the failure and perform any necessary corrections to the equipment.

4. The Contractor shall be held responsible for repair costs due to Contractor negligence, abuse, or incorrect installation of equipment.

5. The Contracting Officer shall be provided a full list of all equipment that is to be removed or replaced by the Contractor, to include description and serial/manufacturer numbers where possible. The Contractor shall dispose of all equipment that has been removed or replaced based upon approval of the Contracting Officer after reviewing the equipment removal list. In all areas

where equipment is removed or replaced the Contractor shall repair those areas to match the current existing conditions.

K. Enclosure Penetrations: All enclosure penetrations shall be from the bottom of the enclosure unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and all penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water and will comply with VA Master Specification 07 84 00, Firestopping. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer and in such a manner that the cable is not damaged.

L. Cold Galvanizing: All field welds and brazing on factory galvanized boxes, enclosures, and conduits shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.

M. Interconnection of Console Video Equipment: The Contractor shall connect signal paths between video equipment as specified by the OEM. Cables shall be as short as practicable for each signal path without causing strain at the connectors. Rack mounted equipment on slide mounts shall have cables of sufficient length to allow full extension of the slide rails from the rack.

N. Cameras:

1. Install the cameras with the focal length lens as indicated for each zone.
2. Connect power and signal lines to the camera.
3. Aim camera to give field of view as needed to cover the alarm zone.
4. Aim fixed mounted cameras installed outdoors facing the rising or setting sun sufficiently below the horizon to preclude the camera looking directly at the sun.
5. Focus the lens to give a sharp picture (to include checking for day and night focus and image quality) over the entire field of view
6. Synchronize all cameras so the picture does not roll on the monitor when cameras are selected.
7. PTZ cameras shall have all preset positions and privacy areas defined and programmed.

O. Monitors:

1. Install the monitors as shown and specified in design and construction documents.

2. Connect all signal inputs and outputs as shown and specified.

3. Terminate video input signals as required.

4. Connect the monitor to AC power.

P. Intentionally left blank

Q. Video Encoder/Decoder

1. Install the Video Encoder/Decoder per design and construction documents, and as specified by the OEM.

3. Connect network camera to video decoder.

4. Connect video encoder to VSS network.

5. Connect video decoder to video matrix, DVR, monitor etc.

6. Connect unit to AC power (UPS).

7. Configure the video encoder/decoder per manufacturer’s recommendation and project requirements.

R. Video Server:

1. Install the video server per design and construction documents, and as specified by the OEM.

2. Connect video server to AC power (UPS).

3. Connect to VSS network.

4. Install operating system and Video Management Software.

5. Provide Video Management Software programming per VA guidance and the requirements provided by the Owner. Programming shall include:

a. Camera names

b. Screen views

c. Camera recording schedules (continuous and event) driven recording. Events include alarms from other systems (sensors), manual input, and video motion detection.

d. Video detection zones for each camera requiring video motion detection

e. Alarm interface

f. Alarm outputs

g. GUI maps, views, icons and actions

h. PTZ controls (presets, time schedules for privacy zones etc.)

i. Reports

S. Video Workstation:

1. Install the video workstation per design and construction documents, and as specified by the OEM.

2. Connect video workstation to AC power (UPS).

3. Connect to VSS network.

4. Install operating system and application software.

5. Provide application software programming per VA guidance and the requirements provided by the Owner. Programming shall include:

a. Screen views

b. Graphical User Interface (GUI) maps, views, icons and actions

c. Alarm outputs

d. Reports

T. Network Switch:

1. Install the network switch per design and construction documents, and as specified by the OEM.

2. Connect network switch to AC power (UPS).

3. Connect network cameras to network switch.

4. Configure the network switch per manufacturer’s recommendation and project requirements.

U. Network Recording Equipment

1. Install the NVR or video storage unit as shown in the design and construction documents, and as specified by the OEM.

2. Connect recording device to AC power (UPS).

3. Connect recording device to network switch as shown and specified.

4. Configure network connections

5. Provide recording unit programming per VA guidance and the requirements provided by the Owner. Programming shall include:

a. Camera names

b. Screen views

c. Camera recording schedules (continuous and event) driven recording. Events include alarms from other systems (sensors), manual input, and video motion detection.

d. Video detection zones for each camera requiring video motion detection

e. Alarm interface

f. Alarm outputs

g. GUI maps, views, icons and actions

h. PTZ controls (presets, time schedules for privacy zones etc.)

i. Reports

V. Video Recording Equipment:

1. Install the video recording equipment as shown in the design and construction documents, and as specified by the OEM.

2. Connect video signal inputs and outputs as shown and specified.

3. Connect alarm signal inputs and outputs as shown and specified.

4. Connect video recording equipment to AC power.

5. Program the video recording equipment;

a. Recording schedules

b. Camera caption

W. Video Signal Equipment:

1. Install the video signal equipment as shown in the design and construction documents, and as specified by the OEM.

2. Connect video or signal inputs and outputs as shown and specified.

3. Terminate video inputs as required.

4. Connect alarm signal inputs and outputs as required.

5. Connect control signal inputs and outputs as required

6. Connect electrically powered equipment to AC power.

X. Camera Housings, Mounts, and Poles:

1. Install the camera housings and mounts as specified by the manufacturer and as shown, provide mounting hardware sized appropriately to secure each camera, housing and mount with maximum wind and ice loading encountered at the site.

2. Provide a foundation for each camera pole as specified and shown.

3. Provide a ground rod for each camera pole and connect the camera pole to the ground rod as specified in Division 26 of the VA Master Specification and the VA Electrical Manual 730.

4. Provide electrical and signal transmission cabling to the mount location via a hardened carrier system from the Physical Access Control System and Database Management to the device.

5. Connect signal lines and AC power to the housing interfaces.

6. Connect pole wiring harness to camera.

3.3 SYSTEM START-UP

A. The Contractor shall not apply power to the VSS System until the following items have been completed:

1. VSS System equipment items and have been set up in accordance with manufacturer's instructions.

2. A visual inspection of the VSS System has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.

3. System wiring has been tested and verified as correctly connected as indicated.

4. All system grounding and transient protection systems have been verified as installed and connected as indicated.

5. Power supplies to be connected to the VSS System have been verified as the correct voltage, phasing, and frequency as indicated.

B. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Resident Engineer and Commissioning Agent. Provide a minimum of 7 days prior notice.

C. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work efforts.

3.4 SUPLEMENTAL CONTRACTOR QUIALITY CONTROL

A. The Contractor shall provide the services of technical representatives who are familiar with all components and installation procedures of the installed VSS System; and are approved by the Contracting Officer.

B. The Contractor will be present on the job site during the preparatory and initial phases of quality control to provide technical assistance.

C. The Contractor shall also be available on an as needed basis to provide assistance with follow-up phases of quality control.

D. The Contractor shall participate in the testing and validation of the system and shall provide certification that the system installed is fully operational as all construction document requirements have been fulfilled.

3.5 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 28 08 00 – COMMISSIONING 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 – "COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS" and related sections for contractor responsibilities for system commissioning.

3.6 DEMONSTRATION AND TRAINING

A. All testing and training shall be compliant with the VA General Requirements, Section 01 00 00, "GENERAL REQUIREMENTS".

B. Provide services of manufacturer's technical representative to instruct security personnel in operation and maintenance of units.

C. Submit training plans and instructor qualifications in accordance with the requirements of Section 28 08 00 – "COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS".

-----END----

SECTION 31 20 00
EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. This section specifies the requirements for furnishing all equipment, materials, labor, tools, and techniques for earthwork including, but not limited to, the following:
   1. Site preparation.
   2. Excavation.
   4. Filling and backfilling.
   5. Grading.
   6. Soil Disposal.
   7. Clean Up.

1.2 DEFINITIONS:

A. Unsuitable Materials:

1.Fills: Topsoil; frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic material, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable and any material with a liquid limit and plasticity index exceeding 40 and 15 respectively. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction, as defined by ASTM D698.

2.Existing Subgrade (Except Footing Subgrade): Same materials as 1.2.A.1, that are not capable of direct support of slabs, pavement, and similar items with possible exception of improvement by compaction, proof rolling, or similar methods.

3.Existing Subgrade (Footings Only): Same as paragraph 1, but no fill or backfill. If materials differ from design requirements, excavate to acceptable strata subject to Resident Engineer's approval.

B. Site Earthwork: Earthwork operations required in area outside of a line located 1500 mm (5 feet) outside of principal building perimeter and within new construction area with exceptions noted above.

C. Degree of compaction: Degree of compaction is expressed as a percentage of maximum density obtained by laboratory test procedure. This percentage of maximum density is obtained through use of data provided from results of field test procedures presented in ASTM D1556, ASTM D2167, and ASTM D6938.

D. Fill: Satisfactory soil materials used to raise existing grades. In the Construction Documents, the term “fill” means fill or backfill as appropriate.

E. Backfill: Soil materials or controlled low strength material used to fill an excavation.

F. Unauthorized excavation: Removal of materials beyond indicated sub-grade elevations or indicated lines and dimensions without written authorization by the Resident Engineer. No payment will be made for unauthorized excavation or remedial work required to correct unauthorized excavation.

G. Authorized additional excavation: Removal of additional material authorized by the Resident Engineer based on the determination by the Government's soils testing agency that unsuitable bearing materials are encountered at required sub-grade elevations. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.

H. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular sub-base, drainage fill, or topsoil materials.

I. Structure: Buildings, foundations, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

J. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

K. Drainage course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

L. Bedding course: Layer placed over the excavated sub-grade in a trench before laying pipe. Bedding course shall extend up to the spring line of the pipe.

M. Sub-base Course: Layer placed between the sub-grade and base course for asphalt paving or layer placed between the sub-grade and a concrete pavement or walk.

N. Utilities include on-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

O. Debris: Debris includes all materials located within the designated work area not covered in the other definitions and shall include but not be limited to items like vehicles, equipment, appliances, building materials or remains thereof, tires, any solid or liquid chemicals or products stored or found in containers or spilled on the ground.

P. Contaminated soils: Soil that contains contaminates as defined and determined by the Resident Engineer or the Government's testing agency.

1.3 RELATED WORK:

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Safety requirements: Section 01 35 26, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.

C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.

1.4 CLASSIFICATION OF EXCAVATION:

A. Classified Excavation: Removal and disposal of all material not defined as Rock.

1.5 MEASUREMENT AND PAYMENT FOR EXCAVATION:

A. Measurement: The unit of measurement for excavation and borrow will be the cubic yard, computed by the average end area method from cross sections taken before and after the excavation and borrow operations, including the excavation for ditches, gutters, and channel changes, when the material is acceptably utilized or disposed of as herein specified. Quantities should be computed by a Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS. The measurement will include authorized excavation of satisfactory subgrade soil, and the volume of loose, scattered rocks and boulders collected within the limits of the work; allowance will be made on the same basis for selected backfill ordered as replacement. The measurement will not include the volume of subgrade material or other material used for purposes other than directed. The volume of overburden stripped from borrow pits and the volume of excavation for ditches to drain borrow its, unless used as borrow material, will not be measured for payment. The measurement will not include the volume of any excavation performed prior to taking of elevations and measurements of the undisturbed grade.

1.6 MEASUREMENT AND PAYMENT FOR ROCK EXCAVATION (NOT USED)

1.7 SUBMITTALS:

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

B. Furnish to Resident Engineer:

1. Contactor shall furnish resumes with all personnel involved in the project including Project Manager, Superintendent, and on-site Engineer. Project Manager and Superintendent should have at least 3 years of experience on projects of similar size.
2. Soil samples.
   a. Classification in accordance with ASTM D2487 for each on-site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.

b. Laboratory compaction curve in accordance with ASTM D698 for each on site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.

c. Test reports for compliance with ASTM D2940 requirements for subbase material.

The Contractor shall submit a scale plan daily that defines the location, limits, and depths of the area excavated.

3. Contractor shall submit procedure and location for disposal of unused satisfactory material. Proposed source of borrow material. Notification of encountering rock in the project. Notification of encountering materials of an archaeological nature. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

1.8 APPLICABLE PUBLICATIONS:

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

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

D698-07e1..... Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft. lbf/ft^3 (600 kN m/m^3))

C. Society of Automotive Engineers (SAE):

J732-07..... Specification Definitions - Loaders

J1179-08..... Hydraulic Excavator and Backhoe Digging Forces

PART 2 - PRODUCTS

2.1 MATERIALS:

A. General: Provide borrow soil material when sufficient satisfactory soil materials are not available from excavations.

B. Engineered Fill: Naturally or artificially graded mixture of compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups, or as approved by the Engineer or material with at least 90 percent passing a 37.5-mm (1 1/2-inch) sieve and not more than 12 percent passing a 75-µm (No. 200) sieve, per ASTM D2940;.

C. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 25 mm (1 inch) sieve and not more than 8 percent passing a 75-µm (No. 200) sieve.

D. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent

passing a 37.5 mm (1 1/2-inch) sieve and 0 to 5 percent passing a 2.36 mm (No. 8) sieve.

F. Granular Fill:

1. Under concrete slab, - granular fill shall consist of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below. Fine aggregate grading shall conform to ASTM C 33 with a maximum of 3 percent by weight passing ASTM D 1140,75 micrometers (No. 200) sieve.

PART 3 - EXECUTION

3.1 SITE PREPARATION:

A. Clearing: Clear within limits of earthwork operations as shown. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash, and other obstructions. Remove materials from Medical Center.

B. Grubbing: Remove stumps and roots 75 mm (3 inch) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inch) diameter, and nonperishable solid objects a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left.

C. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 300 mm (12 inches) on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from Medical Center.

D. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION:

A. Proof rolling:

1. After rough grade has been established in cut areas and prior to placement of fill in fill areas under building and pavements, proof roll exposed subgrade with a fully loaded dump truck to check for pockets of soft material.
2. Proof rolling shall be done on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. with six passes of a 13.6-meter tons (15 ton), pneumatic-tired roller. Operate the roller in a systematic manner to

ensure the number of passes over all areas, and at speeds between 4 to 5.5 km/hour (2 1/2 to 3 1/2 mph). When proof rolling, one half of the passes made with the roller shall be in a direction perpendicular to the other passes. Notify the Resident Engineer a minimum of 3 days prior to proof rolling. Proof rolling shall be performed in the presence of the Resident Engineer. Maintain subgrade until succeeding operation has been accomplished.

B. Building Earthwork:

1. Excavation shall be accomplished as required by drawings and specifications.
2. Excavate foundation excavations to solid undisturbed subgrade.
3. Remove loose or soft materials to a solid bottom.
4. Fill excess cut under footings or foundations with 25 MPa (3000 psi) concrete poured separately from the footings.
5. Do not tamp earth for backfilling in footing bottoms, except as specified. Ensure that footing subgrades have been inspected and approved by the Resident Engineer prior to concrete placement. Excavate to bottom of pile cap prior to placing or driving piles, unless authorized otherwise by the Resident Engineer. Backfill and compact over excavations and changes in grade due to pile driving operations to 95 percent of ASTM D698 maximum density.

C Site Earthwork: Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation. Excavation shall be accomplished as required by drawings and specifications. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 25 mm (1 inch). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, complying with OSHA requirements, and for inspections. Remove subgrade materials that are determined by Resident Engineer as unsuitable, and replace with acceptable material.

1. Site Grading:
   a. Provide a smooth transition between adjacent existing grades and new grades.
   b. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

c. Slope grades to direct water away from buildings and to prevent ponds from forming where not designed. Finish subgrades to required elevations within the following tolerances:
   1) Lawn or Unpaved Areas: Plus or minus 25 mm (1 inch).
   2) Walks: Plus or minus 25 mm (1 inch).
   3) Pavements: Plus or minus 13 mm (1/2 inch).
d. Grading Inside Building Lines: Finish subgrade to a tolerance of 13 mm (1/2 inch) when tested with a 3000 mm (10 foot) straightedge.

3.3 UNDERPINNING (NOT USED)

3.4 FILLING AND BACKFILLING:

A. General: Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation. For fill and backfill, use excavated materials, and borrow meeting the criteria specified herein, as applicable. Borrow will be supplied at no additional cost to the Government. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or damp proofing applied, foundation drainage, and pipes coming in contact with backfill have been installed and work inspected and approved by Resident Engineer.

B. Placing: Place materials in horizontal layers not exceeding 200 mm (8 inches) in loose depth for material compacted by heavy compaction equipment, and not more than 100 mm (4 inches) in loose depth for material compacted by hand-operated tampers and then compacted. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure. Place no material on surfaces that are muddy, frozen, or contain frost.

C. Compaction: Compact with approved tamping rollers, sheepsfoot rollers, pneumatic tired rollers, steel wheeled rollers, vibrator compactors, or other approved equipment (hand or mechanized) well suited to soil being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without prior approval of Resident Engineer. Moisten or aerate material as necessary to provide moisture content that will readily facilitate obtaining specified compaction with equipment used. Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure. Compact soil to not less

than the following percentages of maximum dry density, according to ASTM D698 or ASTM D1557 as specified below:

1. Fills, Embankments, and Backfill
   a. Under proposed structures, building slabs, steps, and paved areas, scarify and recompact top 300 mm (12 inches) of existing subgrade and each layer of backfill or fill material in accordance with ASTM D698.
   b. Curbs, curbs and gutters, ASTM D698.
   c. Under Sidewalks, scarify and recompact top 150 mm (6 inches) below subgrade and compact each layer of backfill or fill material in accordance with ASTM D698.

D. Borrow Material: Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas within the limits of the project site, selected by the Contractor or from approved private sources. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

E. Opening and Drainage of Excavation and Borrow Pits: The Contractor shall notify the Resident Engineer sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.5 GRADING:

A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are

indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.

B. Slope backfill outside building away from building walls for a minimum distance of 1800 mm (6 feet).

3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off property.

B. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.

3.7 CLEAN UP:

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove all debris, rubbish, and excess material from Medical Center.

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SECTION 32 05 23
CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vehicular Pavement: driveways.

1.2 RELATED REQUIREMENTS

A. Field Testing: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Subgrade Preparation and Subbase Compaction: Section 31 20 00, EARTHWORK.

1.3 APPLICABLE PUBLICATIONS

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

B. American Concrete Institute (ACI):

1. 306R 10 - Guide to Cold Weather Concreting.

C. American National Standards Institute (ANSI):

1. B101.3 - Wet DOCF of Common Hard Surface Floor Materials (Including Action and Limit Thresholds for the Suitable Assessment of the Measured Values).

D. ASTM International (ASTM):

1. A615/A615M 16 - Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
2. C33/C33M 16 - Concrete Aggregates.
3. C94/C94M 16 - Ready Mixed Concrete.
4. C143/C143M 15a - Slump of Hydraulic Cement Concrete.
5. C150/C150M 16 - Portland Cement.

1.4 PREINSTALLATION MEETINGS (NOT USED)

1.5 SUBMITTALS

a. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

b. Submittal Drawings:

1. Show size, configuration, and fabrication and installation details.
2. Show reinforcing.
3. Include jointing plan for concrete pavements, curbs and gutters.

c. Manufacturer's Literature and Data:

1. Description of each product.
2. Installation instructions.

d. Samples:

1. Exposed Aggregate Concrete Panel: 0.4 sq. m by 50 mm (4 sq. ft. by 2 inches) thick, 2 required, each color and finish.

2. Colored Concrete Panel: As specified in Section 09 06 00, SCHEDULE FOR FINISHES, with mix data.

e. Test reports: Certify products comply with specifications.
   1. Concrete materials.
   2. Select subbase materials.
   3. Field test reports.

f. Certificates: Certify products comply with specifications.
   1. Expansion joint filler.
   2. Reinforcement.
   3. Curing materials.
   4. Concrete protective coating.

g. Qualifications: Substantiate qualifications comply with specifications.
   1. Installer with project experience list.
   2. Land surveyor.

h. Concrete mix design.

i. Select subbase job-mix design.

j. Proposed hot and cold weather concreting methods.

k. Land surveyor's construction staking notes, before placing concrete.
   1. Identify discrepancies between field conditions and Drawings.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Regularly installs specified products.
   2. Installed specified products with satisfactory service on five similar installations.
      a) Project Experience List: Provide contact names and addresses for completed projects.

B. Land Surveyor: Professional land surveyor or engineer registered to provide land surveys in jurisdiction where project is located.

C. Preconstruction Testing:
   1. Engage independent testing laboratory to perform tests and submit reports.
      a) Deliver samples to laboratory in number and quantity required for testing.
   2. Concrete mix design.
   3. Select subbase job mix design. Report the following:
      a) Material sources.
      b) Gradation.
      c) Plasticity index.
      d) Liquid limit.

e) Laboratory compaction curves indicating maximum density at optimum moisture content.

1.7 DELIVERY

A. Deliver steel reinforcement to prevent damage.

B. Before installation, return or dispose of distorted or damaged steel reinforcement.

C. Bulk Products: Deliver bulk products away from buildings, utilities, pavement, and existing turf and planted areas. Maintain dry bulk product storage away from contaminants.

1.8 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.9 FIELD CONDITIONS

A. Hot Weather Concreting Procedures: ACI 305R.

B. Cold Weather Concreting Procedures: ACI 306R.

1. Use non corrosive, non chloride accelerator admixture.
2. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions.

1.10 WARRANTY

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

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II.

B. Coarse Aggregate: ASTM C33/C33M; size to suit application.

C. Fine Aggregate: ASTM C33/C33M.

D. Mixing Water: Fresh, clean, and potable.

E. Air Entraining Admixture: ASTM C260/C260M.

F. Chemical Admixtures: ASTM C494/C494M.

G. Reinforcing Steel: ASTM A615/A615M or ASTM A996/A996M, Grade 420 (60).

2.2 SELECT SUBBASE

A. Subbase: AASHTO M147; Grade A.

1. Select granular material composed of sand, sand-gravel, crushed stone, crushed or granulated slag, with or without soil binder, or combinations of these materials.

SUBBASE GRADING REQUIREMENTS							
Sieve Size		Percentage Passing by Mass					
		Grades					
(mm)	(in)	A	B	C	D	E	F
50	2	100	100				
25	1		75-95	100	100	100	100
9.5	3/8	30-65	40-75	50-85	60-100		
4.47	No. 4	25-55	30-60	35-65	50-85	55-100	70-100
2.00	No. 10	15-40	20-45	25-50	40-70	40-100	55-100
0.425	No. 40	8-20	15-30	15-30	25-45	20-50	30-70
0.075	No. 200	2-8	5-20	5-15	5-20	6-20	8-25

2.3 FORMS

A. Forms: Wood, plywood, metal, or other materials, approved by Contracting Officer's Representative, of grade or type suitable to obtain type of finish specified.

1. Plywood: Exterior grade, free of defects and patches on contact surface.
2. Lumber: Sound, grade-marked, S4S stress graded softwood, minimum 50 mm (2 inches) thick, free from warp, twist, loose knots, splits, or other defects.
3. Form Coating: As recommended by Architect/Engineer.

B. Provide forms suitable in cross-section, depth, and strength to resist springing during depositing and consolidating concrete.

1. Do not use forms varying from straight line more than 3 mm in 3000 mm (1/8 inch in 10 feet), horizontally and vertically.

C. Provide flexible or curved forms for forming radii.

2.4 CONCRETE CURING MATERIALS

A. Concrete curing materials, conform to one of the following:

1. Burlap: Minimum 233 g/sq. m (7 ounces/sq. yd.) dry.
2. Sheet Materials for Curing Concrete: ASTM C171.

2.5 CONCRETE MIXES

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

B. Concrete Type: Air-entrained

TABLE I - CONCRETE TYPES					
Concrete Type	Minimum 28 Day Compressive Strength f'c MPa (psi)	Non-Air-Entrained		Air-Entrained	
		Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio	Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio
A	35 (5000)1,3	375 (630)	0.45	385 (650)	0.40
B	30 (4000)1,3	325 (550)	0.55	340 (570)	0.50
C	25 (3000)1,3	280 (470)	0.65	290 (490)	0.55
D	25 (3000)1,2	300 (500)	*	310 (520)	*

Footnotes:
1. If trial mixes are used, achieve compressive strength 8.3 MPa (1,200 psi) in excess of f'c. For concrete strengths greater than 35 MPa (5,000 psi), achieve compressive strength 9.7 MPa (1,400 psi) in excess of f'c.
2. For Concrete Exposed to High Sulfate Content Soils: Maximum water cement ratio is 0.44.
3. Laboratory Determined according to ACI 211.1 for normal weight concrete.

C. Maximum Slump: ASTM C143/C143M. See Table II.

TABLE II - MAXIMUM SLUMP	
APPLICATION	MAXIMUM SLUMP
Curb & Gutter	75 mm (3 inches)
Pedestrian Pavement	75 mm (3 inches)
Vehicular Pavement	50 mm (2 inches) Machine Finished 100 mm (4 inches) Hand Finished
Equipment Pad	75 to 100 mm (3 to 4 inches)

2.6 ACCESSORIES

A. Equipment and Tools: Obtain Contracting Officer's Representative's, approval of equipment and tools needed for handling materials and performing work before work begins.
B. Maintain equipment and tools in satisfactory working condition.
C. Sealants:
   1. Concrete Paving Expansion Joints: ASTM D5893/D5893M, Type SL, single component, self-leveling, silicone joint sealant.
   2. Concrete Paving Joints: ASTM D6690, Type IV, hot-applied, single component joint sealant.
D. Concrete Protective Coating: AASHTO M233 linseed oil mixture.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
B. Protect existing construction and completed work from damage.
C. Prepare, construct, and finish subgrade. See Section 31 20 00, EARTHWORK.
D. Maintain subgrade in smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

3.2 SELECT SUBBASE

A. Placing:

1. Place subbase material on prepared subgrade in uniform layer to required contour and grades, and to maximum 200 mm (8 inches) loose depth.
2. When required compacted thickness exceeds 150 mm (6 inches), place subbase material in equal thickness layers.
3. When subbase elevation is 13 mm (1/2 inch) or more below required grade, excavate subbase minimum 75 mm (3 inches) deep. Place and compact subbase to required grade.

B. Compaction:

1. Perform compaction with approved hand or mechanical equipment well suited to the material being compacted.
2. Maintain subbase at optimum moisture content for compaction.

3.3 SETTING FORMS

A. Form Substrate:

1. Compact form substrate to uniformly support forms along entire length.
2. Correct substrate imperfections and variations by cutting, filling, and compacting.

B. Form Setting:

1. Set forms to indicated line and grade with tight joints. Rigidly brace forms preventing movement.
2. Remove forms when removal will not damage concrete and when required for finishing.
3. Clean and oil forms before each use.
4. Correct forms, when required, immediately before placing concrete.

C. Land Surveyor: Establish control, alignment, and grade for forms

1. Notify Contracting Officer's Representative immediately when discrepancies exist between field conditions and drawings.
2. Correct discrepancies greater than 25 mm (1 inch) before placing concrete.

D. Form Tolerances:

1. Variation from Indicated Line: Maximum 6 mm (1/4 inch).
2. Variation from Indicated Grade: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).

3.4 PLACING REINFORCEMENT

A. Keep reinforcement clean from contamination preventing concrete bond.

B. Install reinforcement shown on drawings.

C. Support and securely tie reinforcing steel to prevent displacement during concrete placement.

D. Obtain Contracting Officer's Representative's reinforcement placement approval before placing concrete.

3.5 JOINTS - GENERAL

A. Place joints, where shown on approved submittal Drawings.
   1. Conform to details shown.
   2. Install joints perpendicular to finished concrete surface.
B. Make joints straight and continuous from edge to edge of pavement.

3.6 CONSTRUCTION JOINTS

A. Locate longitudinal and transverse construction joints between slabs of vehicular pavement as shown on approved submittal Drawings.
B. Place transverse construction joints of type shown, where indicated, and whenever concrete placement is suspended for more than 30 minutes.
C. Provide butt-type joint with dowels in curb At planned joint locations.
D. Provide keyed joints with tie bars when joint occurs in middle third of planned curb joint interval.

3.7 CONTRACTION JOINTS

A. Tool or cut joints to width, depth, and radius edge shown on drawings using grooving tool, jointer, or saw.
B. Construct joints in curbs and gutters by inserting 3 mm (1/8 inch) steel plates conforming to curb and gutter cross sections.
   1. Keep plates in place until concrete can hold its shape.
C. Finish joint edges with edging tool.
D. Score pedestrian pavement with grooving tool or jointer.

3.8 EXPANSION JOINTS

A. Form expansion joints with expansion joint filler of thickness shown on drawings.
   1. Locate joints around perimeter of structures and features abutting site work concrete.
   2. Create complete, uniform separation between structure and site work concrete.
B. Extend expansion joint material full depth of concrete with top edge of joint filler below finished concrete surface where sealant is indicated on Drawings.
C. Cut and shape material matching cross section.
D. Anchor with approved devices to prevent displacing during placing and finishing operations.
E. Round joint edges with edging tool.

3.9 PLACING CONCRETE - GENERAL

A. Preparation before Placing Concrete:
   1. Obtain Contracting Officer's Representative approval.

2. Remove debris and other foreign material.
3. Uniformly moisten substrate, without standing water.

B. Convey concrete from mixer to final location without segregation or loss of ingredients. Deposit concrete to minimize handling.

C. During placement, consolidate concrete by spading or vibrating to minimize voids, honeycomb, and rock pockets.
1. Vibrate concrete against forms and along joints.
2. Avoid excess vibration and handling causing segregation.

D. Place concrete continuously between joints without bulkheads.

E. Install construction joint in concrete placement suspended for more than 30 minutes.

F. Replace concrete with cracks, chips, bird baths, and other defects to nearest joints, approved by Contracting Officer's Representative.

3.10 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS

A. Place concrete in one layer conforming to cross section shown on Drawings after consolidating and finishing.

B. Deposit concrete near joints without disturbing joints. Do not place concrete directly onto joint assemblies.

C. Strike concrete surface to proper section ready for consolidation.

D. Consolidate concrete by tamping and spading or with approved mechanical finishing equipment.

E. Finish concrete surface with wood or metal float.

F. Construct concrete pads and pavements with sufficient slope to drain, preventing standing water.

3.11 PLACING CONCRETE FOR VEHICULAR PAVEMENT

A. Deposit concrete as close as possible to its final position.

B. Place concrete continuously between construction joints without cold joints.

C. Strike and consolidate concrete with finishing machine, vibrating screed, or by hand-finishing.

D. Finish concrete surface to elevation and crown shown on drawings.

E. Deposit concrete near joints without disturbing joints. Do not place concrete directly onto joint assemblies.

F. Obtain Contracting Officer's Representative's approval before placing adjacent lanes.

3.12 FORM REMOVAL

A. Keep forms in place minimum 12 hours after concrete placement. Remove forms without damaging concrete.

B. Do not use bars or heavy tools against concrete to remove forms. Repair damage concrete found after form removal.

3.13 CONCRETE FINISHING - GENERAL

A. Follow operation sequence below, unless otherwise indicated on Drawings:
   1. Consolidating, floating, striking, troweling, texturing, and joint edging.
B. Use edging tool with 6 mm (1/4 inch) radius,
C. Keep finishing equipment and tools clean and suitable for use.

3.14 CONCRETE FINISHING - PEDESTRIAN PAVEMENT (

A. Walks, Grade Slabs,:
   1. Finish concrete surfaces with metal float, troweled smooth, and finished with a broom moistened with clear water.
   2. Finish slab edges and formed transverse joints with edger.
   3. Broom surfaces transverse to traffic direction.
      a. Use brooming to eliminate flat surface produced by edger.
      b. Produce uniform corrugations, maximum 1.5 mm (1/16 inch) deep profile.
   4. Provide surface uniform in color and free of surface blemishes, form marks, and tool marks.
   5. Paving Tolerances:
      a. Variation from Indicated Plane: Maximum 5 mm in 3000 mm (3/16 inch in 10 feet).
      b. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).
   6. Replace paving within joint boundary when paving exceeds specified tolerances.

3.15 CONCRETE FINISHING - VEHICULAR PAVEMENT

A. Align finish surfaces where new and existing pavements abut.
B. Longitudinally float pavement surface to profile and grade indicated on drawings.
C. Straighten surface removing irregularities and maintaining specified tolerances while concrete is plastic.
D. Finish pavement edges and joints with edging tool.
E. Broom finish concrete surface after bleed water dissipates and before concrete hardens.
   1. Broom surface transverse to traffic direction.
      a. Use brooming to eliminate flat surface produced by edger.
      b. Produce uniform corrugations, maximum 3 mm (1/8 inch) deep profile.
F. Pavement Tolerances:

1. Variation from Indicated Plane: Maximum 6 mm in 3000 mm (1/4 inch in 10 feet) tested parallel and perpendicular to traffic direction at maximum 1500 mm (5 feet) intervals.
2. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).

G. Replace paving within joint boundary when paving exceeds specified tolerances.

3.16 CONCRETE FINISHING - CURBS AND GUTTERS

A. Round edges of gutter and top of curb with edging tool.

B. Gutter and Curb Top:
1. Float surfaces and finish with smooth wood or metal float until true to grade and section and uniform color.
2. Finish surfaces, while still plastic, longitudinally with bristle brush.

C. Curb Face:
1. Remove curb form and immediately rub curb face with wood or concrete rubbing block removing blemishes, form marks, and tool marks and providing uniform color.
2. Brush curb face, while still plastic, matching gutter and curb top.

D. Curb and Gutter Tolerances: Except at grade changes or curves.
1. Variation from Indicated Plane and Grade:
a. Gutter: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).
b. Curb Top and Face: Maximum 6 mm in 3000 mm (1/4 inch in 10 feet).

E. Replace curbs and gutters within joint boundary when curbs and gutters exceed specified tolerances.

F. Correct depressions causing standing water.

3.17 CONCRETE FINISHING - EQUIPMENT PADS (NOT USED)

3.18 SPECIAL FINISHES (NOT USED)

3.19 CONCRETE CURING

A. Concrete Protection:
1. Protect unhardened concrete from rain and flowing water.
2. Provide sufficient curing and protection materials available and ready for use before concrete placement begins.
3. Protect concrete to prevent pavement cracking from ambient temperature changes during curing period.
a. Replace pavement damaged by curing method allowing concrete cracking.
b. Employ another curing method as directed by Contracting Officer's Representative.

B. Cure concrete for minimum 7 days by one of the following methods appropriate to weather conditions preventing moisture loss and rapid temperature change:

1. Burlap Mat: Provide minimum two layers kept saturated with water during curing period. Overlap Mats at least 150 mm (6 inches).
2. Sheet Materials:
   a. Wet exposed concrete surface with fine water spray and cover with sheet materials.
   b. Overlap sheets minimum 300 mm (12 inches).
   c. Securely anchor sheet materials preventing displacement.
3. Curing Compound:
   a. Protect joints indicated to receive sealants preventing contamination from curing compound.
   b. Insert moistened paper or fiber rope into joint or cover joint with waterproof paper.
   c. Apply curing compound before concrete dries.
   d. Apply curing compound in two coats at right angles to each other.
   e. Application Rate: Maximum 5 sq. m/L (200 sq. ft./gallon), both coats.
   f. Immediately reapply curing compound to surfaces damaged during curing period.

3.20 CONCRETE PROTECTIVE COATING

A. Apply protective coating of linseed oil mixture to exposed-to-view concrete surfaces, drainage structures, and features that project through, into, or against concrete exterior improvements to protect the concrete against deicing materials.
B. Complete backfilling and curing operation before applying protective coating.
C. Dry and thoroughly clean concrete before each application.
D. Apply two coats, with maximum coverage of 11 sq. m/L (50 sq. yds./gal.); first coat, and maximum 16 sq. m/L (70 sq. yds./gal.); second coat, except apply commercially prepared mixture according to manufacturer's instructions.
E. Protect coated surfaces from vehicular and pedestrian traffic until dry.
F. Do not heat protective coating, and do not expose protective coating to open flame, sparks, or fire adjacent to open containers or applicators. Do not apply material at temperatures lower than 10 degrees C (50 degrees F).

3.21 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
   1. Compaction.
      a. Pavement subgrade.
      b. Curb, gutter, and sidewalk.
   2. Concrete:

a. Delivery samples.

b. Field samples.

3. Slip Resistance: Steps and pedestrian paving.

3.22 CLEANING

A. After completing curing:

1. Remove burlap and sheet curing materials.

2. Sweep concrete clean, removing foreign matter from the joints.

3. Seal joints as specified.

3.23 PROTECTION

A. Protect exterior improvements from traffic and construction operations.

1. Prohibit traffic on paving for minimum seven days after placement, or longer as directed by Contracting Officer's Representative.

B. Remove protective materials immediately before acceptance.

C. Repair damage.

1. Replace concrete containing excessive cracking, fractures, spalling, and other defects within joint boundary, when directed by Contracting Officer's Representative, and at no additional cost to the Government.

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SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Chain link fence, gates and accessories.

1.2 RELATED REQUIREMENTS

A. Temporary Construction Fence: Section 01 00 00, GENERAL REQUIREMENTS.

B. Fence Color: Section 09 06 00, SCHEDULE FOR FINISHES.

C. Grounding: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

1.3 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

1. A817-12 - Metal-Coated Steel Wire for Chain-Link Fence Fabric and Marcelled Tension Wire.
2. F567-14a - Installation of Chain-Link Fence.
3. F626-14 - Fence Fittings.
4. Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain Link Fence Fabric.
5. F1184-16 - Industrial and Commercial Horizontal Slide Gates.
6. F1664-08(2013) - Polyvinyl Chloride (PVC) and Other Conforming Organic Polymer Coated Steel Tension Wire used with Chain Link Fence.
7. F1665-08(2013) - Polyvinyl Chloride (PVC) and Other Conforming Organic Polymer Coated Steel Barbed Wire used with Chain Link Fence.
8. F1043-16 - Strength and Protective Coatings on Steel Industrial Fence Framework.
9. F1083-16 - Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

C. Chain Link Fence Manufacturing Institute (CLFMI):

1. Product Manual.

D. Federal Specifications (Fed. Spec.):

1. FF-P-110J - Padlock, Changeable Combination.

E. Master Painters Institute (MPI):

1. No. 18 - Primer, Zinc Rich, Organic.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
   1. Show size, configuration, and fabrication and installation details.
C. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Installation instructions.
D. Certificates: Certify products comply with specifications.
   1. Fence alignment.
   2. Zinc-coating.
E. Qualifications: Substantiate qualifications comply with specifications.
   1. Manufacturer with project experience list.
   2. Installer with project experience list.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Regularly manufactures specified products.
   2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
      a. Project Experience List: Provide contact names and addresses for completed projects.
B. Installer Qualifications:
   1. Regularly installs specified products.
   2. Installed specified products with satisfactory service on five similar installations for minimum five years.
      a. Project Experience List: Provide contact names and addresses for completed projects.
C. Welders and Welding Procedures Qualifications: AWS D1.1/D1.1M.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.
B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Protect products from damage during handling and construction operations.

1.8 WARRANTY

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

PART 2 - RODUCTS

2.1 PRODUCTS - GENERAL

A. Basis of Design: Section 09 06 00, SCHEDULE FOR FINISHES.

B. Provide fences and gates from one manufacturer.

2.2 CHAIN-LINK FENCING AND GATES

A. General: Conform to CLFMI Product Manual.

B. Chain Link Fabric: 50 mm (2 inch) mesh, 3.76 mm (0.15 inches), (84 inches) high, top selvage and bottom selvage.

1. Zinc-Coated Steel Fabric: ASTM A392, hot dipped galvanized before or after weaving.

a. Class 1 - 366 g/sq. m (1.2 oz/sq. ft.).

C. Fence Framework:

1. Round Steel Pipe and Rail: ASTM F1043, Group IA Heavy Industrial Fence Framework, ASTM F1083 schedule 40 galvanized pipe.

a. Line post: 60 mm (2.375 inch) diameter.

b. End, Corner, Pull post: 60 mm (2.375 inch) diameter.

c. Brace rails, top, bottom, and intermediate rails, 42 mm (1.660 inch) diameter, 3.38 kg/m (2.27 lb./ft.).

2.3 TENSION WIRE

A. Metallic Coated Steel Marcelled Tension Wire: ASTM A817, Type II marcelled wire.

2.4 BARBED WIRE (NOT USED)

2.5 FITTINGS

A. General: ASTM F626.

B. Tension and Brace Bands: Galvanized pressed steel.

C. Terminal Post Caps, Line Post Loop Tops, Rail and Brace Ends, Boulevard Clamps, Rail Sleeves: Pressed steel galvanized.

D. Truss Rod Assembly: Steel truss rod with a pressed steel tightener.

E. Tension Bars: Galvanized steel one-piece length 50 mm (2 inches) less than the fabric height.

2.6 TIE WIRE and HOG RINGS

A. Galvanized: Minimum zinc coating 366 g/sq. m (1.20 oz./sq. ft.); 3.76 mm (0.148 inch) diameter steel wire.

B. Polymer coated; match coating, class and color to that of the chain link fabric.

2.7 GATES

A. Horizontal Slide Gates: ASTM F1184.

1. Type II: Cantilever Slide.

a. Class 1 - External Roller Design: Horizontal top and bottom steel pipe “track” members, 60 mm (2.375 inches) OD. Length of back frame support section minimum 40 percent of the opening. Design gates to open or close by applying an initial pull force no greater 18 kg(40 lbs.).Provide safety protective guards for the top and bottom external rollers.

2.8 CONCRETE

A. Concrete: As specified in Section 03 30 00, Cast-in-Place Concrete.

2.9 FINISHES

A. Steel Paint Finish:

1. Powder-Coat Finish: Manufacturer's standard two-coat finish system as follows:
   a. One coat primer.
   b. One coat thermosetting topcoat.
   c. Dry-film Thickness: 0.05 mm (2 mils) minimum.
   d. Color: Refer to Section 09 06 00, SCHEDULE FOR FINISHES.

2.10 ACCESSORIES

A. Primers:

B. Barrier Coating: ASTM D1187/D1187M.

C. Welding Materials: AWS D1.1/D1.1M, type to suit application.

D. Galvanizing Repair Paint: MPI No. 18.

E. Touch-Up Paint: Match shop finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Apply barrier coating to steel surfaces in contact with dissimilar metals and cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

3.2 INSTALLATION

A. Layout fence and locate position of post.

B. Installation:

1. General: Comply with ASTM F567.
2. Framework:
   a. Posts: Set plumb in concrete footings with 600 mm (24 inches) minimum depth.

1) Minimum Footing Diameter: Four times largest cross section of post, up to 100 mm (4 inches) O.D. and three times largest cross section of post greater than 100 mm (4 inches). O.D.
2) Provide larger footings for gate posts. Top of post concrete footing, at grade crowned to shed water away from the post.
3) Space line posts not exceeding 3 m (10 ft.) on center.

b. Top rail: Install 6.4 m (21 ft.) lengths of rail continuous thru line post or barb arm loop top. Splice rail using top rail sleeves minimum 150 mm (6 inches) long.
1) Secure rail to terminal post by brace band and rail end.
2) Field cut and secure bottom rail or intermediate rail to line posts with boulevard bands or rail ends and brace bands.
3) Provide mid rail for fences 3.7 m (12 feet) high or higher.

c. Terminal posts: Brace and truss end, corner, pull and gate posts for fence 1.8 m (6 ft.) and higher and for fences 1.5 m (5 ft.) in height without top rail.

d. Tension wire: Install tension wire 100 mm (4 inches) up from bottom of fabric. Fences without top rail, install tension wire 100 mm (4 inches) down from the top of the fabric.
1) Stretched taut tension wire independently, between terminal posts and secure with brace band.
2) Secure tension wire to chain link fabric with 3.76 mm (0.15 inch) hog rings 450 mm (18 inches) on center and to each line post with tie wire.
3) Install top tension wire through barb arm loop for fences with barbed wire and no top rail.

C. Chain Link Fabric:
1. Install fabric inside of the framework with ground clearance of 50 mm (2 inches) maximum.
2. Stretch fabric between terminal posts and secure with tension bar.
3. Wrap tie wire around the post or rail. Attached to fabric wire picket on both sides. Cut off and bend excess wire to prevent injury.

D. Gate:
1. Horizontal Slide Gates: Install according to manufacturer’s instructions.

E. Nuts and Bolts:
1. Bolts: Install carriage bolts with head on the secure side of the fence. Peened over all bolts shall be to prevent removal of the nut.

F. Electrical Grounding:

1. Grounding: Grounding, when required, as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

G. Touch up damaged factory finishes.

1. Repair galvanized surfaces with galvanized repair paint.
2. Repair painted surfaces with touch up primer.

3.3 CLEANING

A. Clean exposed fence surfaces. Remove contaminants and stains.

3.4 PROTECTION

A. Protect fence from traffic and construction operations.

B. Repair damage.

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