APOGEE
Engineers | Architects

PROJECT SPECIFICATIONS

Department of Veterans Affairs
TENNESSEE VALLEY HCS
NASHVILLE VAMC
VIDEO SURVEILLANCE SECURITY NASHVILLE
VA Project No.626-22-103

Bid Documents
June 13, 2024

Prepared by:
Apogee Consulting Group, PA
1151 Kildaire Farm Road
Cary, NC 27511

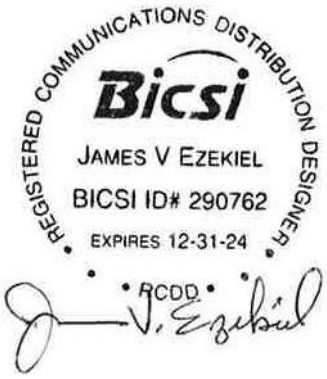
VA | U.S. Department of Veterans Affairs

DocuSign Envelope ID: 88AAD9A3-9E21-4F10-AB30-17235A69E01F

Nashville VAMC
Video Surveillance Security Nashville
Project: 626-22-103

APOGEE
Engineers | Architects

1151 Kildaire Farm Road
Cary, NC 27511
acg-pa.com



Silas P. George, PE
Mechanical Engineer

Garrett R. Gossett, PE
Electrical Engineer

James V. Ezekiel, RCDD
Senior Electrical Designer

Date: June 13, 2024

DEPARTMENT OF VETERANS AFFAIRS
VHA MASTER SPECIFICATIONS

TABLE OF CONTENTS
Section 00 01 10

SECTION NO	DIVISION AND SECTION TITLES	DATE
	DIVISION 01 - GENERAL REQUIREMENTS	
01 00 00	General Requirements	11-21
01 32 16.15	Project Schedules (Small Projects - Design/Bid/Build	01-24
01 33 23	Shop Drawings, Product Data, and Samples	11-23
01 35 26	Safety Requirements for Major Projects	12-23
01 42 19	Reference Standards	11-20
01 45 00	Quality Control	02-21
01 74 19	Construction Waste Management	04-22
	DIVISION 02 – EXISTING CONDITIONS	
02 41 19	Selective Demolition	08-17
	DIVISION 07 - THERMAL AND MOISTURE PROTECTION	
07 84 00	Firestopping	01-21
07 92 00	Joint Sealants	04-22
	DIVISION 09 – FINISHES	
09 29 00	Gypsum Board	04-20
09 51 00	Acoustical Ceilings	12-18
09 91 00	Painting	01-21
	DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)	
23 05 11	Common Work Results for HVAC	03-23
23 05 93	Testing, Adjusting, and Balancing for HVAC	03-23
23 07 11	HVAC and Boiler Plant Insulation	02-20
23 09 23	Direct-Digital Control System for HVAC	03-23
23 31 00	HVAC Ducts and Casings	03-23
23 36 00	Air Terminal Units	03-23
23 37 00	Air Outlets and Inlets	03-23
	DIVISION 26 – ELECTRICAL	
26 05 11	Requirements for Electrical Installations	11-22
26 05 19	Low-Voltage Electrical Power Conductors and Cables	11-22
26 05 26	Grounding and Bonding for Electrical Systems	11-22
26 05 33	Raceway and Boxes for Electrical Systems	11-22
26 24 16	Panelboards	11-22
26 27 26	Wiring Devices	11-22

SECTION NO	DIVISION AND SECTION TITLES	DATE
	DIVISION 27 – COMMUNICATIONS	
27 05 11	Requirements for Communications Installations	09-19
27 05 26	Grounding and Bonding for Communications Systems	06-15
27 05 33	Raceways and Boxes for Communications Systems	10-18
27 10 00	Control, Communication and Signal Wiring	06-15
27 11 00	Telecommunications Room Fittings	06-15
27 11 26	Communications Rack Mounted Power Protection and Power Strips	12-22
27 15 00	Communications Structured Cabling	01-16
	DIVISION 28 – ELECTRONIC SAFETY AND SECURITY	
28 05 00	Common Work Results for Electronic Safety and Security	04-18
28 05 13	Conductors and Cables for Electronic Safety and Security	10-18
28 05 26	Grounding and Bonding for Electronic Safety and Security	09-11
28 05 28.33	Conduits and Backboxes for Electronic Safety and Security	09-11
28 23 00	Video Surveillance	09-11
28 23 10	Network Video Recorder	09-11
28 23 20	Video Management System	09-11
28 23 40	Video IP Cameras	09-11

SECTION 01 00 00
GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SAFETY REQUIREMENTS

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

1.2 GENERAL INTENTION

A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for project 626-22-103 Video Surveillance Security Nashville as required by drawings and specifications.

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

C. Offices of Apogee Consulting Group P.A., as Architect-Engineers, will render certain technical services during construction. Such services shall be considered advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative.

D. Before placement and installation of work subject to tests by testing laboratory retained by Department of Veterans Affairs, the Contractor shall notify the COR in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three workdays unless otherwise designated by the COR.

E. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.

F. **STATEMENT OF BID ITEM(S)**

1. BID ITEM I: Work includes general construction, alterations, improvements, necessary removal of existing structures and construction and certain other items. POP 270 days.
2. BID ITEM II: All items included in BID ITEM I except the 5th floor work. POP 255 days.
3. BID ITEM III: All items included in BID ITEM II except the 4th floor work. POP 240 days.

4. BID ITEM IV: All items included in BID ITEM III except the 3rd floor work. POP 225 days.

1.3 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.

1.4 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 tool boxes and parked machines and take any emergency action.

2. The General Contractor shall purchase permanent lock cylinders and turn over all permanent lock cylinders to the VA locksmith for permanent installation.

D. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of “sensitive information”.
2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
3. Certain documents, sketches, videos or photographs and drawings may be marked “Law Enforcement Sensitive” or “Sensitive Unclassified”. Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the Contracting Officer upon request.
4. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
5. All paper waste or electronic media such as CD’s and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
6. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of “sensitive information”.
7. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
   a) Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.
      “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.

1.5 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 shown on the drawings or as determined by the COR.

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

F. Execute work in such a manner as to interfere as little as possible with work being done by others. Keep roads clear of construction materials, debris, standing construction equipment and vehicles at all times.

G. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of

utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COR where required by limited working space.

1. Do not store materials and equipment in other than assigned areas.
2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to Medical Center areas required to remain in operation.
3. Where access by Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.

H. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and 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. The work to be outlined shall include, but not be limited to:

2. To ensure such executions, Contractor shall furnish the COR with a schedule of approximate phasing dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the COR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such phasing dates to ensure accomplishment of this work in successive phases mutually agreeable to the COR and Contractor.

J. Buildings will be occupied during performance of work; but immediate areas of alterations will be vacated.

1. Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. Contractor shall permit access to Department of Veterans Affairs personnel and patients through other construction areas which serve as routes of access to such affected areas and equipment. These routes whether access or egress shall be isolated from the construction area by temporary partitions and have walking surfaces, lighting etc. to facilitate patient and staff access. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period.

K. 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.

L. When a building and/or construction site is turned over to Contractor, Contractor shall accept entire responsibility including upkeep and maintenance therefore:

1. Contractor shall maintain a minimum temperature of 4 degrees C (40 degrees F) at all times, except as otherwise specified.

2. Contractor shall maintain in operating condition existing fire protection and alarm equipment. In connection with fire alarm equipment, Contractor shall make arrangements for pre-inspection of site with Fire Department or Company (Department of Veterans Affairs or municipal) whichever will be required to respond to an alarm from Contractor's employee or watchman.

M. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR.

1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without a detailed work plan, the Medical Center Director’s prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY for additional requirements.
2. Contractor shall submit a request to interrupt any such services to COR, in writing, 7 days in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COR.

5. In case of a contract construction emergency, service will be interrupted on approval of COR. Such approval will be confirmed in writing as soon as practical.
6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.

N. 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.

O. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles.
2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COR.

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

1.6 ALTERATIONS

A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR of the 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 buildings.

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.

1.7 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.

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

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

B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

C. Refer to FAR clause 52.236-7, "Permits and Responsibilities," which is included in General Conditions. A National Pollutant Discharge Elimination System (NPDES) permit is required for this project. The Contractor is considered an "operator" under the permit and has extensive responsibility for compliance with permit requirements. VA will make the permit application available at the (appropriate medical center) office. The apparent low bidder, contractor and affected subcontractors shall furnish all information and certifications that are required to comply with the permit process and permit requirements. Many of the permit requirements will be satisfied by completing construction as shown and specified. Some requirements involve the Contractor's method of operations and operations planning and the Contractor is responsible for employing best management practices. The affected activities often include, but are not limited to the following:

1. Designating areas for equipment maintenance and repair;
2. Providing waste receptacles at convenient locations and provide regular collection of wastes;
3. Locating equipment wash down areas on site, and provide appropriate control of wash-waters;
4. Providing protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials; and
5. Providing adequately maintained sanitary facilities.

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.
l. Typical response time and repair time expected for various warranted equipment.

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

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

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

C. 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-Life Safety Systems
      1) Fire suppression systems.
      2) Fire alarm system(s).
   b) Code 1-Air Conditioning Systems
      1) Air conditioning leak in part of the building, if causing damage.
      2) Air conditioning system not cooling properly.
   c) Code 1 Doors
      1) Overhead doors not operational, causing a security, fire, or safety problem.
      1) Interior, exterior personnel doors or hardware, not functioning properly, causing security, fire, or safety problem.
   d) Code 3-Doors
      1) Overhead doors not operational.
      2) Interior/exterior personnel doors or hardware not functioning properly.
   e) Code 1-Electrical
      1) Power failure (entire area or any building operational after 1600 hours).
      2) Security lights.
      3) Smoke detectors.
   f) 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).
   g) Code 3-Electrical
      1) Exterior lights not operational.
   h) Code 1-Gas
      1) Leaks and pipeline breaks.
   i) Code 1-Heat
      1) Power failure affecting heat.
   j) Code 1-Plumbing
      1) Hot water heater failure.
      2) Leaking water supply pipes
   k) Code 2-Plumbing

1) Flush valves not operating properly
2) Fixture drain, supply line or any water pipe leaking.
3) Toilet leaking at base.

l) Code 3- Plumbing
1) Leaky faucets.

m) Code 3-Interior
1) Floors damaged.
2) Paint chipping or peeling.
3) Casework damaged.

n) Code 1-Roof Leaks
1) Damage to property is occurring.

o) Code 2-Water (Exterior)
1) No water to facility.

p) Code 2-Water (Hot)
1) No hot water in portion of building listed.

q) 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	
Construction Contractor	
Address	
Telephone number	
Warranty Contact	
Address	
Telephone number	

Warranty Tags	
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.
3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.

5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government.

B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.

C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

D. Any damage to the equipment or excessive wear due to prolonged use will be repaired replaced by the contractor at the contractor’s expense.

1.14 TEMPORARY USE OF EXISTING ELEVATORS

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

1. Contractor makes all arrangements with the COR for use of elevators. The COR will ascertain that elevators are in proper condition. Contractor may use elevators for special nonrecurring time intervals when permission is granted. Personnel for operating elevators will not be provided by the Department of Veterans Affairs.
2. Contractor covers and provides maximum protection of following elevator components:
   a) Entrance jambs, heads soffits and threshold plates.
   b) Entrance columns, canopy, return panels and inside surfaces of car enclosure walls.
   c) Finish flooring.
3. Government will accept hoisting ropes of elevator and rope of each speed governor if they are worn under normal operation. However, if these ropes are damaged by action of foreign matter such as sand, lime, grit, stones, etc., during temporary use, they shall be removed and replaced by new hoisting ropes at the contractors expense.

4. If brake lining of elevators are excessively worn or damaged during temporary use, they shall be removed and replaced by new brake lining at the contractors expense.
5. All parts of main controller, starter, relay panel, selector, etc., worn or damaged during temporary use shall be removed and replaced with new parts at the contractors expense, if recommended by elevator inspector after elevator is released by Contractor.
6. Place elevator in condition equal, less normal wear, to that existing at time it was placed in service of Contractor as approved by Contracting Officer.

1.15 TEMPORARY TOILETS

A. Contractor may have for use of Contractor's workers, such toilet accommodations as may be assigned to Contractor by Medical Center. Contractor shall keep such places clean and be responsible for any damage done thereto by Contractor's workers. Failure to maintain satisfactory condition in toilets will deprive Contractor of the privilege to use such toilets.

1.16 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. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials:
   1. Obtain heat by connecting to Medical Center heating distribution system.
E. 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.
F. Water (for Construction and Testing): Furnish temporary water service.
   1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection as per code. Water is available at no cost to the Contractor.
   2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at COR discretion) of use of water from Medical Center's system.

1.17 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.

1.18 RELOCATED ITEMS

A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing equipment and items indicated by symbol "R" or otherwise shown to be relocated by the Contractor.

B. Perform relocation of such equipment or items at such times and in such a manner as directed by the COR.

C. Suitably cap existing service lines, such as steam, condensate return, water, drain, gas, air, vacuum and/or electrical, at the main whenever such lines are disconnected from equipment to be relocated. Remove abandoned lines in finished areas and cap as specified herein before under paragraph "Abandoned Lines".

D. Provide all mechanical and electrical service connections, fittings, fastenings and any other materials necessary for assembly and installation of relocated equipment; and leave such equipment in proper operating condition.

E. All service lines such as noted above for relocated equipment shall be in place at point of relocation ready for use before any existing equipment is disconnected. Make relocated existing equipment ready for operation or use immediately after reinstallation.

1.19 CONSTRUCTION SIGN

A. Provide a Construction Sign where directed by the COR. All wood members shall be of framing lumber. Cover sign frame with 0.7 mm (24 gage) galvanized sheet steel nailed securely around edges and on all bearings. Provide three 100 by 100 mm (4 inch by 4 inch) posts (or equivalent round posts) set 1200 mm (four feet) into ground. Set bottom of sign level at 900 mm (three feet) above ground and secure to posts with through bolts. Make posts full height of sign. Brace posts with 50 x 100 mm (two by four inch) material as directed.

B. Paint all surfaces of sign and posts two coats of white gloss paint. Border and letters shall be of black gloss paint, except project title which shall be blue gloss paint.

C. Maintain sign and remove it when directed by the COR.

D. Detail Drawing of construction sign showing required legend and other characteristics of sign can be found on the TIL.

1.20 SAFETY SIGN

A. Provide a Safety Sign where directed by COR. Face of sign shall be 19 mm (3/4 inch) thick exterior grade plywood. Provide two 100 mm by 100 mm (four by four inch) posts extending full height of sign and 900 mm (three feet) into ground. Set bottom of sign level at 1200 mm (four feet) above ground.

B. Paint all surfaces of Safety Sign and posts with one prime coat and two coats of white gloss paint. Letters and design shall be painted with gloss paint of colors noted.

C. Maintain sign and remove it when directed by COR.

D. Drawing details in VA Signage Design Manual, Section 11 Specialty Signs (found on VA TIL) show required legend and other characteristics of sign can be found on the TIL.

E. Post the number of accident free days on a daily basis.

1.21 PHOTOGRAPHIC DOCUMENTATION

A. During the construction period through completion, provide photographic documentation of construction progress and at selected milestones including electronic indexing, navigation, storage and remote access to the documentation, as per these specifications. The commercial photographer or the subcontractor used for this work shall meet the following qualifications:

1. Demonstrable minimum experience of three (3) years in operation providing documentation and advanced indexing/navigation systems including a representative portfolio of construction projects of similar type, size, duration and complexity as the Project.
2. Demonstrable ability to service projects throughout North America, which shall be demonstrated by a representative portfolio of active projects of similar type, size, duration and complexity as the Project.

B. Photographic documentation elements:

1. Each digital image shall be taken with a professional grade camera with minimum size of 6 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. Indexing and navigation system shall utilize actual AUTOCAD construction drawings, making such drawings interactive on an on-line interface. For all documentation referenced herein, indexing and navigation must be organized by both time (date-stamped) and location throughout the project.
3. Documentation shall combine indexing and navigation system with inspection-grade digital photography designed to capture actual conditions throughout construction and at critical milestones.

Documentation shall be accessible on-line through use of an internet connection. Documentation shall allow for secure multiple-user access, simultaneously, on-line.

4. Before construction, the building pad, adjacent streets, roadways, parkways, driveways, curbs, sidewalks, landscaping, adjacent utilities and adjacent structures surrounding the building pad and site shall be documented. Overlapping photographic techniques shall be used to ensure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings. If site work or pad preparation is extensive, this documentation may be required immediately before construction and at several pre-determined intervals before building work commences.
5. 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.
6. As-built condition of pre-foundation utilities and site utilities shall be documented prior to pouring footers, placing concrete and/or backfilling. This process shall include all underground and in-slab utilities within the building(s) envelope(s) and utility runs in the immediate vicinity of the building(s) envelope(s). This may also include utilities enclosed in slab-on-deck in multi-story buildings. Overlapping photographic techniques shall be used to ensure maximum coverage. Indexing and navigation accomplished through interactive site utility plans.
7. 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.

8. As-built conditions of exterior skin and elevations shall be documented with an increased concentration of digital photographs as directed by the COR in order to capture pre-determined focal points, such as waterproofing, window flashing, radiused steel work, architectural or Exterior Insulation and Finish Systems (EIFS) detailing. Overlapping photographic techniques shall be used to ensure maximum coverage. Indexing and navigation accomplished through interactive elevations or elevation details.
9. 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.
10. 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.
11. Customizable project-specific digital photographic documentation of other details or milestones. Indexing and navigation accomplished through interactive architectural plans.
12. Monthly (29 max) exterior progressions (360 degrees around the project) and slideshows (all elevations and building envelope). The slideshows allow for the inclusion of Department of Veterans Affairs pictures, aerial photographs, and timely images which do not fit into any regular monthly photopath.
13. Weekly (21 Max) Site Progressions - Photographic documentation capturing the project at different stages of construction. These progressions shall capture underground utilities, excavation, grading, backfill, landscaping and road construction throughout the duration of the project.
14. 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.
15. Detailed Exact-Built of all Slabs for all project slab pours just prior to placing concrete or as directed by the COR.

16. 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 COR.
17. Finished detailed Interior exact built overlapping photos of all walls, ceilings, and floors to be scheduled by COR prior to occupancy.
18. 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. Images shall be taken by a commercial photographer and must show distinctly, at as large a scale as possible, all parts of work embraced in the picture.

D. Coordination of photo shoots is accomplished through COR. Contractor shall also attend construction team meetings as necessary. Contractor’s operations team shall provide regular updates regarding the status of the documentation, including photo shoots concluded, the availability of new Progressions or Exact-Builts viewable on-line and anticipated future shoot dates.

E. Contractor shall provide all on-line domain/web hosting, security measures, and redundant server back-up of the documentation.

F. Contractor shall provide technical support related to using the system or service.

G. Upon completion of the project, final copies of the documentation (the “Permanent Record”) with the indexing and navigation system embedded (and active) shall be provided in an electronic media format, typically a DVD or external hard drive. Permanent Record shall have Building Information Modeling (BIM) interface capabilities. On-line access terminates upon delivery of the Permanent Record.

1.22 FINAL ELEVATION DIGITAL IMAGES

A. A minimum of four (4) images of each elevation shall be taken with a minimum 6 MP camera, by a professional photographer with different settings to allow the COR to select the image to be printed. All images are provided to the RE on a CD.

B. Photographs shall be taken upon completion, including landscaping. They shall be taken on a clear sunny day to obtain sufficient detail to show

depth and to provide clear, sharp pictures. Pictures shall be 400 mm x 500 mm (16 by 20 inches), printed on regular weight paper, matte finish archival grade photographic paper and produced by a RA4 process from the digital image with a minimum 300 PPI. Identifying data shall be carried on label affixed to back of photograph without damage to photograph and shall be similar to that provided for final construction photographs.

C. Furnish six (6) 400 mm x 500 mm (16 by 20 inch) color prints of the following buildings constructed under this project (elevations as selected by the RE from the images taken above). Photographs shall be artistically composed showing full front elevations. All images shall become property of the Government. Each of the selected six prints shall be place in a frame with a minimum of 2 inches of appropriate matting as a border. Provide a selection of a minimum of 3 different frames from which the SRE will select one style to frame all six prints. Photographs with frames shall be delivered to the COR in boxes suitable for shipping.

1.23 HISTORIC PRESERVATION

A. Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible archeological, historical and/or cultural resources, the Contractor shall immediately notify the COR verbally, and then with a written follow up.

- - - E N D - - -

SECTION 01 32 16.15
PROJECT SCHEDULES
(Small Projects – Design/Bid/Build)

PART 1- GENERAL

1.1 DESCRIPTION:

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

1.2 CONTRACTOR'S REPRESENTATIVE:

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

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

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

1.3 CONTRACTOR'S CONSULTANT:

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

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

B. The Contracting Officer has the right to approve or disapprove the proposed consultant and will notify the Contractor of the VA decision

within seven calendar days from receipt of the qualification proposal. In case of disapproval, the Contractor shall resubmit another consultant within 10 calendar days for renewed consideration. The Contractor shall have their scheduling consultant approved prior to submitting any schedule for approval.

1.4 COMPUTER PRODUCED SCHEDULES

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

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

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

1.5 THE COMPLETE PROJECT SCHEDULE SUBMITTAL

A. Within 45 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review; three blue line copies of the interim schedule on sheets of paper 765 x 1070 mm (30 x 42 inches) and an electronic file in the previously approved CPM schedule program. The submittal shall also include three copies of a computer-produced activity/event ID schedule showing project duration; phase completion dates; and other data, including event cost.

Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, activity/event description, duration, budget amount, early start date, early finish date, late start date, late finish date and total float. Work activity/event relationships shall be restricted to finish-to-start or start-to-start without lead or lag constraints. Activity/event date constraints, not required by the contract, will not be accepted unless submitted to and approved by the Contracting Officer. The contractor shall make a separate written detailed request to the Contracting Officer identifying these date constraints and secure the Contracting Officer’s written approval before incorporating them into the network diagram. The Contracting Officer’s separate approval of the Project Schedule shall not excuse the contractor of this requirement. Logic events (non-work) will be permitted where necessary to reflect proper logic among work events but must have zero duration. The complete working schedule shall reflect the Contractor's approach to scheduling the complete project. **The final Project Schedule in its original form shall contain no contract changes or delays which may have been incurred during the final network diagram development period and shall reflect the entire contract duration as defined in the bid documents.** These changes/delays shall be entered at the first update after the final Project Schedule has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time as a result of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

B. Within 30 calendar days after receipt of the complete project interim Project Schedule and the complete final Project Schedule, the Contracting Officer or his representative, will do one or both of the following:
   1. Notify the Contractor concerning his actions, opinions, and objections.
   2. A meeting with the Contractor at or near the job site for joint review, correction or adjustment of the proposed plan will be scheduled if required. Within 14 calendar days after the joint review, the Contractor shall revise and shall submit three blue line copies of the revised Project Schedule, three copies of the revised

computer-produced activity/event ID schedule and a revised electronic file as specified by the Contracting Officer. The revised submission will be reviewed by the Contracting Officer and, if found to be as previously agreed upon, will be approved.

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

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

1.6 WORK ACTIVITY/EVENT COST DATA

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

B. The Contractor shall cost load work activities/events for guarantee period services, test, balance and adjust various systems in accordance with the provisions in Article, FAR 52.232 – 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.232 Article 70 Without NAS-CPM or Article 71 Including NAS-CPM for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION).

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

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

1.7 PROJECT SCHEDULE REQUIREMENTS

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

1. Show activities/events as:
   a. Contractor's time required for submittal of shop drawings, 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 COR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will not be less than 20 work days.
4. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion. Activities/events labeled

"start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.

5. The schedule shall be generally numbered in such a way to reflect either discipline, phase or location of the work.

B. The Contractor shall submit the following supporting data in addition to the project schedule:

1. The appropriate project calendar including working days and holidays.
2. The planned number of shifts per day.
3. The number of hours per shift.

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

C. To the extent that the Project Schedule or any revised Project Schedule shows anything not jointly agreed upon, it shall not be deemed to have been approved by the 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 COTR’s approval of the Project Schedule.

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

1.8 PAYMENT TO THE CONTRACTOR:

A. Monthly, the contractor shall submit an application and certificate for payment using VA Form 10-6001a or the AIA application and certificate for payment documents G702 & G703 reflecting updated schedule activities and cost data in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, FAR 52.232 – 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.232 – Article 70 Without NAS-CPM or 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 an electronic file (s) of the resulting monthly updated schedule.

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

1.9 PAYMENT AND PROGRESS REPORTING

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

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

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

C. After completing the monthly schedule update, the contractor's representative or scheduling consultant shall rerun all current period contract change(s) against the prior approved monthly project schedule. The analysis shall only include original workday durations and schedule logic agreed upon by the contractor and COR for the contract change(s).

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

D. Following approval of the CPM schedule, the VA, the General Contractor, its approved CPM Consultant, RE office representatives, and all subcontractors needed, as determined by the SRE, shall meet to discuss the monthly updated schedule. The main emphasis shall be to address work activities to avoid slippage of project schedule and to identify any necessary actions required to maintain project schedule during the reporting period. The Government representatives and the Contractor should conclude the meeting with a clear understanding of those work and administrative actions necessary to maintain project schedule status during the reporting period. This schedule coordination meeting will occur after each monthly project schedule update meeting utilizing the resulting schedule reports from that schedule update. If the project is behind schedule, discussions should include ways to prevent further slippage as well as ways to improve the project schedule status, when appropriate.

1.10 RESPONSIBILITY FOR COMPLETION

A. If it becomes apparent from the current revised monthly progress schedule that phasing or contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:

1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
3. Reschedule the work in conformance with the specification requirements.

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

1.11 CHANGES TO THE SCHEDULE

A. Within 30 calendar days after VA acceptance and approval of any updated project schedule, the Contractor shall submit a revised electronic file (s) and a list of any activity/event changes including predecessors and successors for any of the following reasons:
1. Delay in completion of any activity/event or group of activities/events, which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as the direct cause for delaying the project beyond the acceptable limits.
2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
3. The schedule does not represent the actual prosecution and progress of the project.
4. When there is, or has been, a substantial revision to the activity/event costs regardless of the cause for these revisions.

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

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

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

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

1.12 ADJUSTMENT OF CONTRACT COMPLETION

A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the 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 shall 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.

- - - E N D - - -

---INTENTIONALLY BLANK---

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. Submittals must be delivered in a logical sequence relative to the critical path of the contract and must be delivered with consideration for lead times associated with equipment. Materials and equipment with powered connections, structural supports or other coordinated devices must be delivered on a similar timeline so that interdependent submittals can be reviewed concurrently to ensure alignment.

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, schedules, and other data specifically prepared by the Contractor to illustrate details of a portion of the work. The purpose of shop drawings is to demonstrate the Contractor's understanding of the design intent, ensure proper coordination with adjoining construction and other trades, and provide sufficient information for fabrication and installation. Shop drawings must include sufficiently detailed and accurate to enable fabrication

and installation of the work without further clarification or interpretation. The shop drawings shall be reviewed and approved by the Contractor prior to submission to the Architect/Engineer for review. Shop drawings shall include, but not be limited to:

1. Clearly defined layouts and orientations
2. Identification of critical dimensions and installation locations
3. Coordination with adjoining construction and interface with other trades and disciplines
4. Indication of required roof, wall, and floor openings
5. Demonstration of relationships to adjacent work
6. Incorporation of coordination with other trades such as structural, mechanical, electrical, fire protection, etc. that is required for full integration of the work

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.

L. Confirmation Letter from Manufacturer: document issued by a manufacturer or General Contractor (GC) during the preconstruction phase, providing assurance that specified products or services will meet the project's requirements. The purpose of this letter is to demonstrate the manufacturer's or GC's commitment to comply with the stated specifications and standards, facilitate the Architect-Engineer's (AE) approval process, allocate risk appropriately, and ensure accountability for product performance and compliance post-installation. The Confirmation Letter shall include, but not be limited to:

1. A clear statement of the manufacturer's or GC's commitment to comply with the project's specifications and standards
2. Identification of the specific products or services covered by the letter
3. Acknowledgment of the manufacturer's or GC's responsibility to ensure the products or services meet the project's requirements
4. A statement that the manufacturer or GC will provide all necessary documentation, test reports, and compliance evidence upon request.

1.3 SUBMITTAL REGISTER

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

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

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

D. 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. The Contractor shall schedule, submit, review, and obtain approval for submittals prior to the acquisition of the material or equipment to ensure compliance with project requirements and to avoid delays in the work.

B. The Contractor shall furnish a complete submittal schedule showing all submittals required for the project and when each item will be submitted for approval. Schedule to be submitted to VA and AE within 14 calendar days from NTP. The submittal schedule shall be coordinated with the planned construction sequence and lead times to ensure timely delivery of materials and equipment and to avoid delays in the work. The submittal schedule shall clearly identify the following:

1. Lead times for each submittal, including time for preparation, review, revision, and approval
2. Critical path submittals that directly impact the project schedule
3. Alignment of submittal dates with the corresponding construction schedule activities)

C. The Contractor shall coordinate scheduling, sequencing, preparing, and

processing of submittals with performance of work to ensure that the work progresses according to the project schedule and is not delayed by submittal processing. The Contractor shall allow sufficient time for review and approval of submittals, taking into account the complexity of the submittal and the potential for revisions and resubmittals.

D. For any submittals or RFIs reopened by the VA Contracting Officer or Contractor needing additional clarification from the Architect/Engineer, the Contractor shall compile all additional questions and clarification requests into the original submittal/RFI form. The submittal/RFI shall reference the original number and the Contractor shall resubmit this to the Architect/Engineer as a new revision, with a revision number (e.g. Rev 1), to supersede the previous version. The Contractor shall clearly identify all changes made in the revised submittal/RFI to facilitate efficient review and approval.

E. The Contractor shall be responsible for ensuring that all submittals are complete, accurate, and submitted in a timely manner to avoid delays in the work. No delay costs or time extensions will be allowed for time lost due to incomplete or late submittals. The Contractor shall proactively track and manage open review comments to ensure timely resolution and approval of submittals. The Contractor shall regularly update and maintain the submittal schedule to reflect the current status of each submittal and its impact on the overall project schedule.)

1.5 SUBMITTAL PREPARATION

A. Each submittal package shall be complete with all required sub-components as stated in the submittal requirements for the given spec section compiled into a single, cohesive submittal for each material, product, unit of work, or system. Submittals shall contain sufficient detail to allow ready determination of compliance with contract requirements. The Contractor shall ensure that each submittal package is comprehensive and self-contained, enabling efficient review and approval without the need for cross-referencing or additional information.

B. The Contractor shall collect required data for each specific material, product, unit of work, or system into a single submittal package. The Contractor shall coordinate with manufacturers and subcontractors in

advance per requirements in individual specification sections to determine all data required for approval. The Contractor shall be responsible for ensuring that all required data is obtained and included in the submittal package, and shall delineate choices, options, and portions applicable to the project.) Partial submittals will not be accepted for expedition of construction effort. Incomplete submittals will be returned without review.

C. It is the Contractor's responsibility to pre-coordinate all submittals before submissions to the VA Contracting Officer to streamline reviews and minimize rejections. The Contractor shall establish a process for internal review and coordination of submittals prior to submission to ensure completeness, accuracy, and compliance with project requirements.)

D. The Contractor shall remove all irrelevant or unnecessary data from the submittal to facilitate accuracy and timely processing. Submittals that contain an excessive amount of irrelevant or unnecessary data will be returned without review. The Contractor shall be responsible for ensuring that each submittal is concise, well-organized, and focused on the specific material, product, unit of work, or system being submitted for approval.

E. Submittals must be timed so that interdependent submittals are delivered on a similar timeline.

F. By specification section, submittals must be provided as complete single packages, including all relevant data, product information, licenses, certificates, and test results. The Contractor shall ensure that all sub-parts of a submittal under a single specification section are compiled and submitted together as a comprehensive package.

G. The contractor shall make every effort to compile a comprehensive submittal package that includes all required components such as product data, samples, test reports, certificates, and other items as specified in the contract documents. If the contractor is unable to provide a complete package, GC must clearly communicate any missing components to the AE and the VA within the submittal package. At a minimum, a complete submittal package should consist of the following:

01 - PRECON SUBMITTALS

02 - SHOP DRAWINGS

03 - PRODUCT DATA

04 - SAMPLES

05 - DESIGN DATA

06 - TEST REPORTS

07 - CERTIFICATES

08 - MANUFACTURER'S INSTALLATION INSTRUCTIONS

09 - WARRANTY INFORMATION

10 - MAINTENANCE INSTRUCTIONS

11 - INSTALLATION INSTRUCTIONS

H. 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 18R1, to indicate resubmission.
   7. Product identification and location in project.

I. 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.

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

K. 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. The Contractor shall provide an online construction document management platform for use by all parties at the Contractor's expense. The

purpose of this platform is to facilitate efficient communication, collaboration, and document sharing among project stakeholders throughout the construction process. The platform shall meet the following performance requirements:

1. Accessibility: The platform shall be accessible from the VA computer network and support files of any size. Email shall not be used as the primary method for submitting files, but may be used for notification purposes.
2. Functionality: The platform shall have features typical of construction platforms, including version control, access permissions, file organization, full-text search capabilities, and user activity logs. These features shall enable users to easily navigate, locate, and manage project documents while maintaining data security and integrity.
3. Usability: The Contractor shall be responsible for setting up, providing, training, and maintaining the document management platform for the duration of the construction contract. The platform shall be user-friendly and intuitive, requiring minimal training for project stakeholders to effectively utilize its features.
4. Reliability: The document management platform shall be a professionally developed and supported commercial software product designed specifically for organizing, managing, and sharing construction project information. Generic consumer file sharing platforms shall not be permitted. The platform shall demonstrate a proven track record of reliability and performance in the construction industry.
5. Security: The platform shall incorporate robust security measures to protect sensitive project data, including secure data storage, encryption, and user access controls. The Contractor shall ensure that the platform complies with all relevant data protection regulations and VA security requirements.
6. Scalability: The platform shall be capable of accommodating the anticipated volume of project documents and users throughout the construction process. It shall maintain consistent performance and responsiveness as the project progresses and the number of documents and users increases.

Prior to selection and implementation, the Contractor shall submit the proposed platform to the Contracting Officer and Architect-Engineer for approval. The submission shall include documentation demonstrating how the proposed platform meets the specified performance requirements. Alternative platforms will be considered provided they meet the criteria described herein regarding access, capabilities, security, support, and intended use for construction projects.

E. 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. The Contractor shall clearly identify and label the specified selections, as per the contract documents, for each color, finish, pattern, or texture required for the project. If the Contractor submits a range of options without specifying the recommended selections, the VA reserves the right to request clarification or make the final selection from the submitted options.

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

A. 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. The VA's approval of submittals is for product specifications, not performance. The actual performance of materials and products is dependent on proper installation, maintenance, and other factors beyond the scope of the VA's submittal review.

B. Conditional approval is granted when a submittal is satisfactory at the time of review, but final approval is contingent upon submission and acceptance of related submittals that impact overall system functionality and compliance. The contractor may proceed with work related to the conditionally approved submittal but acknowledges that modifications may be required based on review of future related submittals to ensure interdependent components collectively meet system design criteria. Full acceptance is pending final review of associated submittals and verification of cross-compatibility of all interconnected elements.

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

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

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

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

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

1. "FURNISH AS CORRECTED": authorizes the contractor to proceed with

the Work covered provided the contractor incorporates the noted comments And makes the noted corrections.

2. "FURNISHED AS SUBMITTED": authorizes the contractor to proceed with the work covered as submitted.
3. "NO ACTION TAKEN": indicates the submittal was received but no action was taken by the VA at this time.
4. "NO EXCEPTIONS TAKEN": indicates the VA has reviewed the submittal and takes no exceptions to the work proposed. Contractor may proceed with work as submitted.
5. "PARTIAL RESUBMITTAL REQUIRED": contractor shall proceed with parts of work not affected by portions of submittal noted as requiring revision and resubmission.
6. “REJECTED”: submittal does not conform to contract requirements. Contractor shall not proceed with work submitted. Revise submittal per va comments and corrections and resubmit. No work shall proceed for this item until resubmittal is approved.
7. “REVIEWED”: submittal has been reviewed by VA. No further VA action required at this time. The ae defers judgement of compliance to the VA.
8. "REVISE AND RESUBMIT": submittal does not comply with contract requirements or is incomplete. Resubmit appropriate changes and corrections for further VA review prior to proceeding with work. No work shall proceed for this item until resubmittal is approved.
9. "CONDITIONALLY APPROVED": submittal is satisfactory at this time but final approval is contingent upon submission and acceptance of related submittals that impact overall system functionality and compliance. Contractor may proceed with work related to this submittal but acknowledges that modifications may be required based on review of future related submittals to ensure interdependent components collectively meet system design criteria. Full acceptance is pending final review of associated submittals and verification of cross-compatibility of all interconnected elements.

H. 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.

I. 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.

J. 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.

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

1.11 WITHHOLDING OF PAYMENT

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

- - - E N D - - -

---INTENTIONALLY BLANK---

SECTION 01 35 26
SAFETY REQUIREMENTS

PART 1 - GENERAL

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 Health Requirements Publication No. EM 385-1-1, 2014 edition

1.2 DEFINITIONS:

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

B. OSHA "Competent Person" (CP). One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)).

C. Competent Person, Confined Space

D. 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.

E. Competent Person, Cranes and Rigging.

F. 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.

H. 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.

I. Competent Person, Fall Protection

J. 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.

K. Competent Person, Scaffolding

L. 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.

M. Competent Person (CP) Trainer

N. 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.

O. High Risk Activities

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

Q. "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.

R. Qualified Person, Fall Protection (QP for FP)

S. 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.

T. USACE Property and Equipment

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

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

W. 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.

X. 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:

   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). These incidents must be investigated and are required to be reported to the VA within 2 hours.

h. 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.

Y. Load Handling Equipment (LHE)

Z. 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).

1. 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 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;

2. Notifications and Reports;

3. Mishap Reports; G

4. Near-Miss Reports;

5. LHE Inspection Reports

D. Work Plans

1. Standard Lift Plan; G

2. Critical Lift Plan; G

3. 3. Activity Hazard Analysis (AHA)

4. 4. Confined Space Entry Permit

5. 5. Hot Work Permit

6. 6. Radiography Operation Planning Work Sheet; G

7. 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. 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 COR.

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 United States Army Corps of Engineers – Safety and Health Requirements Manual - EM 385-1-1-2014. Model language and format can be found in Appendix A of the EM 385-1-1-2014 Manual

2. Address both the Prime Contractors and the subcontractors work operations.

3. State measures to be taken to control hazards associated with materials, services, or equipment provided by suppliers.

4. Address all the elements/sub-elements and in order as follows:

   a. **SIGNATURE SHEET.** Title, signature, and phone number of the following:

      1) Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience);

      2) Plan approver (company/corporate officers authorized to obligate the company);

      3) Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).

   b. **BACKGROUND INFORMATION.** List the following:

      1) Contractor;

      2) Contract number;

      3) Project name;

4) Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).

c. **STATEMENT OF SAFETY AND HEALTH POLICY.** Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor's written safety program goals, objectives, and accident experience goals for this contract should be provided. The Statement of Safety and Health Policy must be signed by a company executive.

d. RESPONSIBILITIES AND LINES OF AUTHORITIES. Provide the following:

1) A statement of the employer's ultimate responsibility for the implementation of his SOH program;

2) Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.

3) The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA or EM 385-1-1 Competent/Qualified Person(s) requirements must be attached.;

4) Requirements that no work shall be performed unless a designated competent person is present on the job site;

5) Requirements for pre-task Activity Hazard Analysis (AHAs);

6) Lines of authority;

7) Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;

e. **SUBCONTRACTORS AND SUPPLIERS.** If applicable, provide procedures for coordinating SOH activities with other employers on the job site:

1) Identification of subcontractors and suppliers (if known);

2) Safety responsibilities of subcontractors and suppliers.

f. TRAINING.

1) Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.

2) Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space, etc.…) and any requirements for periodic retraining/recertification are required.

3) Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.

4) OSHA 10-hour Construction Outreach training within the past five years is required for all workers on site and the OSHA 30-hour Construction Outreach training within the past five years is required for Trade Competent Persons (CPs)

g. SAFETY AND HEALTH INSPECTIONS.

1) Specific assignment of responsibilities for a minimum daily job site safety and health inspection during

periods of work activity: Who will conduct (e.g., "Site Safety and Health CP"), proof of inspector's training/qualifications, when inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures.

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

h. Mishap Investigation & Reporting.

1) The APP shall include identify person(s) responsible to provide the following to the COR:

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

b) Mishap investigation reports;

c) Project site injury and illness logs;

d) Near-Miss reports;

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

1) Emergency response;

2) Contingency for severe weather;

3) Fire Prevention;

4) Medical Support;

5) Posting of emergency telephone numbers;

6) Prevention of alcohol and drug abuse;

7) Site sanitation (housekeeping, drinking water, toilets);

8) Night operations and lighting;

9) Hazard communication program;

10) Welding/Cutting “Hot” work;

11) Electrical Safe Work Practices (Electrical LOTO/NFPA 70E);

12) General Electrical Safety;

13) Hazardous energy control (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).

C. Submit the APP to the COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

D. Once accepted by the COR, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer in accordance with FAR Clause 52.236-13, *Accident Prevention*, until the matter has been rectified.

E. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the COR. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the COR 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 the COR and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

1. The names of the Competent/Qualified Person(s) required for a particular activity (for example, excavations, scaffolding, fall protection, other activities as specified by OSHA, EM 385-1-1, or other State and Local agencies) shall be identified and included in the AHA. Certification of their competency/qualification shall be submitted to the Government Designated Authority (GDA) for acceptance prior to the start of that work activity.

2. The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified person(s).

   a. If more than one Competent/Qualified Person is used on the AHA activity, a list of names shall be submitted as an attachment to the AHA. Those listed must be Competent/Qualified for the type of work involved in the AHA and familiar with current site safety issues.

   b. If a new Competent/Qualified Person (not on the original list) is added, the list shall be updated (an administrative action not requiring an updated AHA). The new person shall acknowledge in writing that he or she has reviewed the AHA and is familiar with current site safety issues.

3. Submit AHAs to the COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP

DRAWINGS, PRODUCT DATA AND SAMPLES for review at least 15 calendar days prior to the start of each phase. Subsequent AHAs as shall be formatted as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

4. The AHA list will be reviewed periodically (at least 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 CONFERENCE:

A. Contractor representatives who have a responsibility or significant role in implementation of the accident prevention program, as required by 29 CFR 1926.20(b)(1), on the project shall attend the pre-construction conference to gain a mutual understanding of its implementation. This includes the project superintendent, subcontractor superintendents, and any other assigned safety and health professionals.

B. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, establish a

schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.

1.8 SAFETY MEETINGS:

A. Conduct safety meetings to review past activities, plan for new or changed operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent Safety and Occupational Health (SOH) training and motivation. Conduct meetings at least once a month for all supervisors on the project location. The SSHO, supervisors, foremen, or CDSOs must conduct meetings at least once a week for the trade workers. Document meeting minutes to include the date, persons in attendance, subjects discussed, and names of individual(s) who conducted the meeting. Maintain documentation on-site and furnish copies to the Contracting Officer on request. Notify the Contracting Officer of all scheduled meetings 7 calendar days in advance.

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

A. The Prime Contractor shall provide a Safety oversight team that includes a minimum of one (1) person at each project site, for each shift, to function as the Site Safety and Health Officer (SSHO), and an Alternate Safety Officer. 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 qualified 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 Primary 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.

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

C. These Competent Persons can have collateral duties as the subcontractor's superintendent and/or work crew lead persons as well as fill more than one specialized CP role (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations). However, the SSHO has be a separate qualified individual from the Prime Contractor's Superintendent and/or Quality Control Manager with duties only as the SSHO

D. The SSHO or an equally qualified Designated Representative/alternate will maintain a presence on the site during construction operations in accordance with FAR Clause 52.236-6: *Superintendence by the Contractor*. CPs will maintain presence during their construction activities in accordance with above mentioned clause. A listing of the designated SSHO and all

known CPs shall be submitted prior to the start of work as part of the APP with the training documentation and/or AHA as listed in Section 1.8 below.

E. The repeated presence of uncontrolled hazards during a contractor's work operations will result in the designated CP as being deemed incompetent and result in the required removal of the employee in accordance with FAR Clause 52.236-5: Material and Workmanship, Paragraph (c).

1.10 TRAINING:

A. The designated Prime Contractor SSHO must meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the requirements of 29 CFR 1926.16 and other appropriate Federal, State and local requirements are met for the project.

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

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

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

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

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

D. All designated CPs shall have completed the OSHA 30-hour Construction Safety course and/or EM 385-1-1 40-hour training within the past 5 years. In addition, all CPs with high hazard work operations (such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations) shall have a specialized formal course in the hazard recognition and control associated with those high hazard work operations. Documented “repeat” deficiencies in the execution of safety requirements will require retaking the requisite formal course.

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

F. Submit training records associated with the above training requirements to for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction conference for acceptance.

G. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the SSHO or his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, emergency procedures, accident reporting etc... Documentation shall be provided to the COR that individuals have undergone contractor’s safety briefing.

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

1.11 INSPECTIONS:

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

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 COR 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 COR within one week of the onsite inspection.

1.12 MISHAPS, OSHA 300 LOGS, AND MAN-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, accidental property damage (both government and contractor) and Near-Misses that occur on site. Notify and provide an initial report to the COR 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 COR 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 COR within 7 calendar days of the accident. The COR will provide copies of any required or special forms.

C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be reported to the COR.

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 COR monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the COR 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 CORin 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 COR 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 COR 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. Barrier Doors: Self Closing Two-hour fire rated solid core wood in steel frame, painted

3. Dust proof Two-hour fire rated drywall

4. High Efficiency Particulate Air-Equipped filtration machine rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer’s instructions.

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

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

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

8. Portable Ceiling Access Module

1.15 DUST CONTROL

A. Contractor shall verify that dust will not be introduced into the medical center 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 the COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. This plan may be an element of the Accident Prevention Plan.

B. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.

C. 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 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 Two-hour fire rated temporary construction partitions as shown on drawings to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.

3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.

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

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

6. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COR.

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

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

G. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with COR. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the COR.

H. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with COR.

I. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR at least 72 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

J. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to COR.

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

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

M. 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. 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. 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 COR 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 COR.

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 COR and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

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, unless specified differently or 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.

1. The use of a Safety Monitoring System (SMS) as a fall protection method is prohibited.

2. The use of Controlled Access Zone (CAZ) as a fall protection method is prohibited.

3. A Warning Line System (WLS) may ONLY be used on floors or flat or low-sloped roofs (between 0 - 18.4 degrees or 4:12 slope) and shall be erected around all sides of the work area (See 29 CFR 1926.502(f) for construction of WLS requirements). Working within the WLS does not require FP. No worker shall be allowed in the area between the roof or floor edge and the WLS without FP. FP is required when working outside the WLS.

4. Fall protection while using a ladder will be governed by the more stringent of OSHA and EM 385-1-1 requirements.

1.20 SCAFFOLDS AND OTHER WORK PLATFORMS

A. All scaffolds and other work platforms construction activities shall comply with 29 CFR 1926 Subpart L.

B. The fall protection (FP) threshold height requirement is 4 ft as stated in Section 1.16.

C. The following hierarchy and prohibitions shall be followed in selecting appropriate work platforms.

1. Scaffolds, platforms, or temporary floors shall be provided for all work except that can be performed safely from the ground or similar footing.

2. Ladders less than 20 feet may be used as work platforms only when use of small hand tools or handling of light material is involved.

3. Ladder jacks, lean-to, and prop-scaffolds are prohibited.

4. Emergency descent devices shall not be used as working platforms.

D. Contractors shall use a scaffold tagging system in which all scaffolds are tagged by the Competent Person. Tags shall be color-coded: green indicates the scaffold has been inspected and is safe to use; red indicates the scaffold is unsafe to use. Tags shall be readily visible, made of materials that will withstand the environment in which they are used, be legible and shall include:

1. The Competent Person’s name and signature;

2. Dates of initial and last inspections.

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

1.21 EXCAVATION AND TRENCHES

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

B. All excavations and trenches 24 inches in depth or greater shall require a written trenching and excavation permit (NOTE – some

States and other local jurisdictions require separate state/jurisdiction-issued excavation permits). The permit shall have two sections, one section will be completed prior to digging or drilling and the other will be completed prior to personnel entering the excavations greater than 5 feet in depth. Each section of the permit shall be provided to the COR prior to proceeding with digging or drilling and prior to proceeding with entering the excavation. After completion of the work and prior to opening a new section of an excavation, the permit shall be closed out and provided to the COR The permit shall be maintained onsite, and the first section of the permit shall include the following:

1. Estimated start time & stop time
2. Specific location and nature of the work.
3. Indication of the contractor's "Competent Person" (CP) in excavation safety with qualifications and signature. Formal course in excavation safety is required by the contractor's CP.
4. Indication of whether soil or concrete removal to an offsite location is necessary.
5. Indication of whether soil samples are required to determined soil contamination.
6. Indication of coordination with local authority (i.e. "One Call") or contractor's effort to determine utility location with search and survey equipment.
7. Indication of review of site drawings for proximity of utilities to digging/drilling.

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

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

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

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

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

C. As required by OSHA 29 CFR 1926.651(b)(1), the estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably

may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

1. The planned dig site will be outlined/marked in white prior to locating the utilities.
2. Used of the American Public Works Association Uniform Color Code is required for the marking of the proposed excavation and located utilities.
3. 811 will be called two business days before digging on all local or State lands and public Right-of Ways.
4. Digging will not commence until all known utilities are marked.
5. Utility markings will be maintained

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

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

1.22 CRANES

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

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

C. A detailed lift plan for all lifts shall be submitted to the COR 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.

D. Crane operators shall not carry loads

1. over the general public or VAMC personnel

2. over any occupied building unless

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

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

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

the roof is sufficient to protect against the potential loss of a load being lifted or a minimum of 300 psf of protection is provided, whichever is greater.

1.23 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

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

1.24 CONFINED SPACE ENTRY

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

B. A site-specific Confined Space Entry Plan (including permitting process) shall be developed and submitted to the COR.

1.25 WELDING AND CUTTING

A. As specified in section 1.14, Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR at least 72 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

1.26 LADDERS

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

B. All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.

C. Manufacturer safety labels shall be in place on ladders

D. Step Ladders shall not be used in the closed position

E. Top steps or cap of step ladders shall not be used as a step

F. Portable ladders, used as temporary access, shall extend at least 3 ft (0.9 m) above the upper landing surface.

1. When a 3 ft (0.9-m) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist workers in mounting and dismounting the ladder.

2. In no case shall the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.

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

1.27 FLOOR & WALL OPENINGS

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

B. Floor and roof holes/openings are any that measure over 2 in (51 mm) in any direction of a walking/working surface which persons may trip or fall into or where objects may fall to the level below. Skylights located in floors or roofs are considered floor or roof hole/openings.

C. All floor, roof openings or hole into which a person can accidentally walk or fall through shall be guarded either by a railing system with toe boards along all exposed sides or a load-

bearing cover. When the cover is not in place, the opening or hole shall be protected by a removable guardrail system or shall be attended when the guarding system has been removed, or other fall protection system.

1. Covers shall be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.

2. Covers shall be secured when installed, clearly marked with the word “HOLE”, “COVER” or “Danger, Roof Opening-Do Not Remove” or color-coded or equivalent methods (e.g., red or orange “X”). Workers must be made aware of the meaning for color coding and equivalent methods.

3. Roofing material, such as roofing membrane, insulation or felts, covering or partly covering openings or holes, shall be immediately cut out. No hole or opening shall be left unattended unless covered.

4. Non-load-bearing skylights shall be guarded by a load-bearing skylight screen, cover, or railing system along all exposed sides.

5. Workers are prohibited from standing/walking on skylights.

- - - E N D - - -

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

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

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

A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to – GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.

B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

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

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

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

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

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

AA Aluminum Association Inc.
http://www.aluminum.org

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

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

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

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

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

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

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

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

ADC Air Diffusion Council
http://flexibleduct.org

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

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

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

AH American Hort
https://www.americanhort.org

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

AIA American Institute of Architects

http://www.aia.org

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

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

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

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

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

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

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

ARPM Association for Rubber Product Manufacturers
https://arpm.com

ASABE American Society of Agricultural and Biological Engineers
https://www.asabe.org

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

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

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

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

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

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

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

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

BHMA	Builders Hardware Manufacturers Association https://www.buildershardware.com
BIA	The Brick Industry Association http://www.gobrick.com
CAGI	Compressed Air and Gas Institute https://www.cagi.org
CGA	Compressed Gas Association, Inc. https://www.cganet.com
CI	The Chlorine Institute, Inc. https://www.chlorineinstitute.org
CISCA	Ceilings and Interior Systems Construction Association https://www.cisca.org
CISPI	Cast Iron Soil Pipe Institute https://www.cispi.org
CLFMI	Chain Link Fence Manufacturers Institute https://www.chainlinkinfo.org
CPA	Composite Panel Association https://www.compositepanel.org
CPMB	Concrete Plant Manufacturers Bureau https://www.cpmb.org
CRA	California Redwood Association http://www.calredwood.org
CRSI	Concrete Reinforcing Steel Institute https://www.crsi.org
CTI	Cooling Technology Institute https://www.cti.org
DHA	Decorative Hardwoods Association https://www.decorativehardwoods.org
DHI	Door and Hardware Institute https://www.dhi.org
EGSA	Electrical Generating Systems Association http://www.egsa.org
EEI	Edison Electric Institute https://www.eei.org
EPA	United States Environmental Protection Agency https://www.epa.gov

ETL	ETL Testing Services http://www.intertek.com
FAA	Federal Aviation Administration https://www.faa.gov
FCC	Federal Communications Commission https://www.fcc.gov
FPS	Forest Products Society http://www.forestprod.org
GANA	Glass Association of North America http://www.glasswebsite.com
FM	Factory Mutual Global Insurance https://www.fmglobal.com
GA	Gypsum Association https://gypsum.org
GSA	General Services Administration https://www.gsa.gov
HI	Hydraulic Institute http://www.pumps.org
ICC	International Code Council https://shop.iccsafe.org
ICEA	Insulated Cable Engineers Association https://www.icea.net
ICAC	Institute of Clean Air Companies http://www.icac.com
IEEE	Institute of Electrical and Electronics Engineers https://www.ieee.org\
IGMA	Insulating Glass Manufacturers Alliance https://www.igmaonline.org
IMSA	International Municipal Signal Association http://www.imsasafety.org
MBMA	Metal Building Manufacturers Association https://www.mbma.com
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry http://msshq.org
NAAMM	National Association of Architectural Metal Manufacturers https://www.naamm.org

PHCC	Plumbing-Heating-Cooling Contractors Association https://www.phccweb.org
NBS	National Bureau of Standards See - NIST
NBBI	The National Board of Boiler and Pressure Vessel Inspectors https://www.nationalboard.org
NEC	National Electric Code See - NFPA National Fire Protection Association
NEMA	National Electrical Manufacturers Association https://www.nema.org
NFPA	National Fire Protection Association https://www.nfpa.org
NHLA	National Hardwood Lumber Association https://www.nhla.com
NIH	National Institute of Health https://www.nih.gov
NIST	National Institute of Standards and Technology https://www.nist.gov
NELMA	Northeastern Lumber Manufacturers Association, Inc. http://www.nelma.org
NPA	National Particleboard Association (See CPA, Composite Panel Association)
NSF	National Sanitation Foundation http://www.nsf.org
OSHA	Occupational Safety and Health Administration Department of Labor https://www.osha.gov
PCA	Portland Cement Association https://www.cement.org
PCI	Precast Prestressed Concrete Institute https://www.pci.org
PPI	Plastics Pipe Institute https://www.plasticpipe.org
PEI	Porcelain Enamel Institute http://www.porcelainenamel.com
PTI	Post-Tensioning Institute http://www.post-tensioning.org

RFCI	Resilient Floor Covering Institute https://www.rfci.com
RIS	Redwood Inspection Service (See Western Wood Products Association) https://www.wwpa.org
SCMA	Southern Cypress Manufacturers Association http://www.cypressinfo.org
SDI	Steel Door Institute http://www.steeldoor.org
SJI	Steel Joist Institute https://www.steeljoist.org
SMACNA	Sheet Metal & Air-Conditioning Contractors' National Association https://www.smacna.org
SSPC	The Society for Protective Coatings https://www.sspc.org
STI	Steel Tank Institute https://www.steeltank.com
SWI	Steel Window Institute https://www.steelwindows.com
TCNA	Tile Council of North America https://www.tcnatile.com
TEMA	Tubular Exchanger Manufacturers Association http://www.tema.org
TPI	Truss Plate Institute https://www.tpinst.org
UBC	The Uniform Building Code (See ICC)
UL	Underwriters' Laboratories Incorporated https://www.ul.com
ULC	Underwriters' Laboratories of Canada https://www.ulc.ca
WCLB	West Coast Lumber Inspection Bureau http://www.wclib.org
WDMA	Window and Door Manufacturers Association https://www.wdma.com

WRCLA Western Red Cedar Lumber Association

https://www.realcedar.com

WWPA Western Wood Products Association

http://www.wwpa.org

- - - E N D - - -

SECTION 01 45 00
QUALITY CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

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

1.2 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM)

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

1.3 SUBMITTALS

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

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

PART 2 PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

Establish and maintain an effective quality control (QC) system. that complies with the FAR Clause 52.246.12 titled “Inspection of Construction”. QC consists of plans, procedures, and organization

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

3.2 CQC PLAN:

A. Submit the CQC Plan no later than 15 days after receipt of Notice to Proceed (NTP) proposed to implement the requirements of the FAR Clause 52.246.12 titled "Inspection of Construction". The Government will consider an Interim CQC Plan for the first 15 days of operation, which must be accepted within 5 business days of NTP. Design and/or construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an Interim plan applicable to the particular feature of work to be started. Work outside of the accepted Interim CQC Plan will not be permitted to begin until acceptance of a CQC Plan or another Interim CQC Plan containing the additional work scope is accepted.

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

1. A description of the QC organization, including a chart showing lines of authority and acknowledgement that the CQC staff will implement the three phase control system for all aspects of the work specified. Include a CQC System Manager that reports to the project superintendent.

2. The name, qualifications (in resume format) duties, responsibilities, and authorities of each person assigned a CQC function.
3. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the Contract. Letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities will to the Contracting Officer or Authorized designee. be issued by the CQC System Manager. Furnish copies of these letters
4. Procedures for scheduling, reviewing, certifying, and managing submittals including those of subcontractors, designers of record, consultants, A/E’s offsite fabricators, suppliers and purchasing agents. These procedures must be in accordance with Section 01 33 23 Shop Drawings, Product Data, and Samples.
5. Control, verification, and acceptance of testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer or Authorized designee are required to be used)
6. Procedures for tracking Preparatory, Initial, and Follow-Up control phases and control, verification, and acceptance tests including documentation.
7. Procedures for tracking design and construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected.
8. Reporting procedures, including proposed reporting formats.
9. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks has separate control requirements, and is identified by different trades or disciplines, or it is work by the same trade in a different environment. Although each section of specifications can generally be considered as a definable feature of work, there are frequently

more than one definable feature under a particular section. This list will be agreed upon during the Coordination meeting.

C. Additional Requirements for Design Quality Control (DQC) Plan: The following additional requirements apply to the DQC Plan for DB projects only and not DBB projects:

1. Submit and maintain a DQC Plan as an effective QC program which assures that all services required by this contract are performed and provided in a manner that meets professional architectural and engineering quality standards. As a minimum, all documents must be technically reviewed by competent, independent reviewers identified in the DQC Plan. The same element that produced the product may not perform the independent technical review (ITR). Correct errors and deficiencies in the design documents prior to submitting them to the Government.
2. Include the design schedule in the master project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific Contract period. This should be at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. Include review and correction periods associated with each item. This should be a forward planning as well as a project monitoring tool. The schedule reflects calendar days and not dates for each activity. If the schedule is changed, submit a revised schedule reflecting the change within 7 calendar days. Include in the DQC Plan the discipline-specific checklists to be used during the design and quality control of each submittal. Submit at each design phase as part of the project documentation these completed discipline-specific checklists.
3. Implement the DQC Plan by a DQC Manager who has the responsibility of being cognizant of and assuring that all documents on the project have been coordinated. This individual must be a person who has verifiable engineering or architectural design experience and is a Professional Engineer or Registered Architect within the state of Construction location. Notify the Contracting Officer or Authorized designee, in writing, of the name of the individual, and the name of an alternate person assigned to the position.

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

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

3.3 COORDINATION MEETING:

After the Preconstruction Conference Post-award Conference before start of design or construction, and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer or Authorized designee to discuss the Contractor's quality control system. Submit the CQC Plan a minimum of 5 business days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CC operations, design activities (if applicable), control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the Government, signed by both the Contractor and Contracting Officer or Authorized designee and will become a part of the contract file. There can be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings or address deficiencies in the CQC system or procedures which can require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION:

A. Personnel Requirements: The requirements for the CQC organization are a Safety and Health Manager, CQC System Manager, a Design Quality Manager (if applicable), and sufficient number of additional qualified personnel to ensure safety and Contract compliance. The Safety and Health Manager shall satisfy the requirements of Specification 01 35 26 Safety Requirements and reports directly to a senior project (or corporate) official independent from the CQC System Manager. The Safety

and Health Manager will also serve as a member of the CQC Staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff maintains a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure Contract compliance. The CQC staff will be subject to acceptance by the Contracting Officer or Authorized designee. Provide adequate office space, filing systems, and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly complete and furnish all letters, material submittals, shop drawings submittals, schedules and all other project documentation to the CQC organization. The CQC organization is responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Government.

B. CQC System Manager: Identify as CQC System Manager an individual within the onsite work organization that is responsible for overall management of CQC and has the authority to act in all CQC matters for the Contractor. The CQC system Manager is required to be a graduate engineer, graduate architect, or a graduate of construction management, with a minimum of PM or SRE. This CQC System manager is on the site at all times during construction and is employed by the General Contractor. The CQC System Manger is assigned as CQC System Manager but has duties as project superintendent in addition to quality control. Identify in the plan an alternate to serve in the event of the CDQC System Manager's absence. The requirements for the alternate are the same as the CQC System Manager.

C. CQC Personnel: In addition to CQC personnel specified elsewhere in the contract, provide as part of the CQC organization specialized personnel to assist in the CQC System Manager for the following areas, as applicable: electrical, mechanical, civil, structural, environmental, architectural, materials technician submittals clerk, Commissioning Agent/LEED specialist, and low voltage systems. These individuals or specified technical companies are directly employed by the General Contractor and cannot be employed by a supplier or subcontractor on this project, must be responsible to the CQC System Manager must be

physically present at the construction site during work on the specialized personnel's areas of responsibility, and must have the necessary education or experience in accordance with the Experience Matrix listed herein. These individuals can perform other duties but need to be allowed sufficient time to perform the specialized personnel's assigned quality controls duties as described in the CQC Plan. A single person can cover more than one area provided that the single person is qualified to perform QC activities in each designated and that workload allows.

EXPERIENCE MATRIX

Area	Qualifications
Civil	Graduate Civil Engineer or Construction Manager with 2 years experience in the type of work being performed on this project or technician with 5 years related experience.
Mechanical	Graduate Mechanical Engineer with 2 years experience or construction professional with 5 years of experience supervising mechanical features of work in the field with a construction company.
Electrical	Graduate Electrical Engineer with 2 years related experience or construction professional with 5 years of experience supervising electrical features of work in the field with a construction company.
Structural	Graduate Civil Engineer (with Structural Track or Focus), Structural Engineer, or Construction Manager with 2 years experience or construction professional with 5 years experience supervising structural features of work in the field with a construction company.
Architectural	Graduate Architect with 2 years experience or construction professional with 5 years of related experience.
Environmental	Graduate Environmental Engineer with 3 years experience.
Submittals	Submittal Clerk with 1 year experience.
Concrete, Pavement, and Soils	Materials Technician with 2 years experience for the appropriate area.

Area	Qualifications
Testing, Adjusting, and Balancing (TAB)	Specialist must be a member of AABC or an experienced technicaion of the firm certified by the NEBB.
Design Quality Control Manager	Registered Architect or Professional Engineer

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

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

3.5 SUBMITTALS AND DELIVERABLES:

A. Submittals have to comply with the requirements in Section 01 33 23 Shop Drawings, Product Data, and Samples. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the contract requirements.

3.6 CONTROL:

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

1. Preparatory Phase: This phase is performed prior to beginning work on each definable feature of work after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase includes:

   a. A review of each paragraph of applicable specifications, references codes, and standards. Make available during the preparatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be

accomplished in the field. Maintain and make available in the field for use by Government personnel until final acceptance of the work.

b. Review of the Contract drawings.

c. Check to assure that all materials and equipment have been tested, submitted, and approved.

d. Review of provisions that have been made to provide required control inspection and testing.

e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the Contract.

f. Examination of required materials, equipment, and sample work to assure that they are on hand conform to approved shop drawings or submitted data, and are properly stored.

g. Review of the appropriate Activity Hazard Analysis (AHA) to assure safety requirements are met.

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

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

k. Discussion of the initial control phase.

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

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

1. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the Preparatory meeting.
2. Verify adequacy of controls to ensure full contract compliance. Verify the required control inspection and testing is in compliance with the contract.
3. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
4. Resolve all differences.
5. Check safety to include compliance with an upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
6. The Government needs to be notified at least 48 hours or 2 business days in advance of beginning the initial phase for definable features of work. Prepare separate minutes of this phase by the CQC System Manager and attach to the daily CQC report. Indicate the exact location of initial phase for definable feature of work for future reference and comparison with Follow-Up phases.
7. The initial phase for each definable feature of work is repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

C. Follow-Up Phase: Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements until the completion of the particular feature of work. Record the checks in the CQC documentation. Conduct final Follow-Up checks and correct all deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work. Additional Preparatory and Initial Phases on the same definable features of work if: the quality ongoing work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.7 TESTS

A. Testing Procedure: Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, furnish to the Government

duplicate samples of test specimens for possible testing by the Government. Testing includes operation and acceptance test when specified. Procure the services of a Department of Veteran Affairs approved testing laboratory or establish an approved testing laboratory at the project site. Perform the following activities and record and provide the following data:

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

3.8 COMPLETION INSPECTION

A. Punch-Out Inspection: Conduct an inspection of the work by the CQC system Manager near the end of the work, or any increment of the work established by the specifications. Prepare and include in the CQC documentation a punch list of items which do not conform to the approved drawings and specifications. Include within the list of deficiencies the estimated date by which the deficiencies will be corrected. Make a second inspection the CQC System Manager or staff to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government Pre-Final Inspection.

B. Pre-Final Inspection: The Government will perform the Pre-Final Inspection to verify that the facility is complete and ready to be

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

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

3.9 DOCUMENTATION

A. Quality Control Activities: Maintain current records providing factual evidence that required QC activities and tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:

1. The name and area of responsibility of the Contractor/Subcontractor
2. Operating plant/equipment with hours worked, idle, or down for repair.
3. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.

4. Test and control activities performed with results and references to specification/drawing requirements. Identify the Control Phase (Preparatory, Initial, and/or Follow-Up). List deficiencies noted, along with corrective action.
5. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specification/drawing requirements.
6. Submittals and deliverables reviewed, with Contract reference, by whom, and action taken.
7. Offsite surveillance activities, including actions taken.
8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
9. Instructions given/received and conflicts in plans and specifications.
10. Provide documentation of design quality control activities. For independent design reviews, provide, as a minimum, identification of the Independent Technical Reviewer (ITR) team, the ITR review comments, responses, and the record of resolution of the comments.

B. Verification Statement: Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the Contract. Furnish the original and one copy of these records in report form to the Government daily with 1 week after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, prepare and submit on report for every 7 days of no work and on the last day of a no work period. All calendar days need to be accounted for throughout the life of the contract. The first report following a day of no work will be for that day only. Reports need to be signed and dated by the CQC System Manager. Include copies of test reports and copies of reports prepared by all subordinate QC personnel within the CQC System Manager Report.

3.10 SAMPLE FORMS

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

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

---END---

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

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

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

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

D. Waste Management Plan development and implementation.

E. Techniques to minimize waste generation.

F. Sorting and separating of waste materials.

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

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

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

1. Soil.
2. Inerts (eg, concrete, masonry and asphalt).
3. Clean dimensional wood and palette wood.
4. Green waste (biodegradable landscaping materials).
5. Engineered wood products (plywood, particle board and I-joists, etc).
6. Metal products (eg, steel, wire, beverage containers, copper, etc).
7. Sheathings
8. Cardboard, paper and packaging.
9. Bitumen roofing materials.
10. Plastics (eg, ABS, PVC).
11. Carpet and/or pad.
12. Gypsum board.
13. Insulation.
14. Paint.
15. Fluorescent lamps.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
   1. Excess or unusable construction materials.
   2. Packaging used for construction products.
   3. Poor planning and/or layout.
   4. Construction error.
   5. Over ordering.
   6. Weather damage.
   7. Contamination.
   8. Mishandling.
   9. Breakage.

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

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

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

E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations.

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

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

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

1.4 TERMINOLOGY

A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.

B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.

C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.

D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.

E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).

F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.

G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.

H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.

I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.

J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.

K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.

L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.

1. On-site Recycling – Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
2. Off-site Recycling – Materials hauled to a location and used in an altered form in the manufacture of new products.

M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.

N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.

O. Return: To give back reusable items or unused products to vendors for credit.

P. Salvage: To remove waste materials from the site for resale or re-use by a third party.

Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.

R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.

S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

1.5 SUBMITTALS

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

B. Prepare and submit to the COR a written demolition debris management plan. The plan shall include, but not be limited to, the following information:

1. Procedures to be used for debris management.
2. Techniques to be used to minimize waste generation.
3. Analysis of the estimated job site waste to be generated:
   a. List of each material and quantity to be salvaged, reused, recycled.

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

4. Detailed description of the Means/Methods to be used for material handling.
   a. On site: Material separation, storage, protection where applicable.
   b. Off site: Transportation means and destination. Include list of materials.
      1) Description of materials to be site-separated and self-hauled to designated facilities.
      2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
         a) The names and locations of mixed debris reuse and recycling facilities or sites.
         b) The names and locations of trash disposal landfill facilities or sites.
         c) Documentation that the facilities or sites are approved to receive the materials.

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

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

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

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

1.6 APPLICABLE PUBLICATIONS

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

B. U.S. Green Building Council (USGBC): LEED Green Building Rating System for New Construction

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

1.7 RECORDS

A. Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 COLLECTION

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

3.2 DISPOSAL

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

3.3 REPORT

A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.
B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates

removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.

C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

- - - E N D - - -

---INTENTIONALLY BLANK---

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Salvage of existing items to be reused or recycled.

1.2 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.3 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

B. Schedule of selective demolition activities with starting and ending dates for each activity.

C. Predemolition photographs or video.

1.5 CLOSEOUT SUBMITTALS

A. Inventory of items that have been removed and salvaged.

1.6 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will temporarily relocate the following items:

a. All moveable medical equipment

b. Any items that Owner feels need to be temporarily relocated

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

G. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or

unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

C. Inventory and record the condition of items to be removed and salvaged.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
   a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
   c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
   d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.
4. Maintain fire watch as per Division 1 Safety requirements

5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
6. Dispose of demolished items and materials promptly. Comply with Division 1 requirements.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:
1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete

3.6 CLEANING

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent

3. spillage on adjacent surfaces and areas.
4. Remove debris from elevated portions of building by chute, hoist,
5. or other device that will convey debris to grade level in a
6. controlled descent.
7. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

- - E N D - - -

SECTION 07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.1 DESCRIPTION

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

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

1.2 RELATED WORK

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

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

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

1.3 SUBMITTALS

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

B. Installer qualifications.

C. Inspector qualifications.

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

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

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

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

1.4 DELIVERY AND STORAGE

A. Deliver materials in their original unopened containers with manufacturer’s name and product identification.

B. Store in a location providing protection from damage and exposure to the elements.

1.5 QUALITY ASSURANCE

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

B. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991 or been evaluated by UL and found to comply

with UL's "Qualified Firestop Contractor Program Requirements." Submit qualification data.

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

1.6 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

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

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

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

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

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

C. FM Global (FM):

Annual Issue Approval Guide Building Materials

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

D. Underwriters Laboratories, Inc. (UL):

Annual Issue Building Materials Directory

E. Annual Issue Fire Resistance Directory

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

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

F. Intertek Testing Services - Warnock Hersey (ITS-WH):

Annual Issue Certification Listings

G. Environmental Protection Agency (EPA):

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

PART 2 - PRODUCTS

2.1 FIRESTOP SYSTEMS

A. Provide either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke. Firestop systems to accommodate building movements without impairing their integrity.

B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 101 mm (4 inches) nominal pipe or 0.01 square meter (16 square inches) in overall cross sectional area.

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

1. Contain no flammable or toxic solvents.
2. 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 inches) or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means acceptable to the firestop manufacturer.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

2.2 SMOKE STOPPING IN SMOKE PARTITIONS

A. Provide silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.

B. Provide mineral fiber filler and bond breaker behind sealant.

C. Sealants to have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with ASTM E84.

D. When used in exposed areas capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

A. Remove dirt, grease, oil, laitance and form-release agents from concrete, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.

B. Remove insulation on insulated pipe for a distance of 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.

- - - E N D - - -

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION:

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

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

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

B. Sound Rated Gypsum Partitions/Sound Sealants: Section 09 29 00, GYPSUM BOARD.

C. Mechanical Work: Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.3 QUALITY ASSURANCE:

A. Installer Qualifications: An experienced installer with a minimum of three (3) years' experience and who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance. Submit qualification.

B. Source Limitations: Obtain each type of joint sealant through one (1) source from a single manufacturer.

C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
3. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

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

1. Adhesion Testing: Before installing elastomeric sealants, test their adhesion to protect joint substrates according to the method in ASTM C794 to determine if primer or other specific joint preparation techniques are required.

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

E. Conduct field tests for each application indicated below:
1. Each type of elastomeric sealant and joint substrate indicated.
2. Each type of non-elastomeric sealant and joint substrate indicated.

F. Notify COR seven (7) days in advance of dates and times when test joints will be erected.

1.4 CERTIFICATION:

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

1.5 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Installer qualifications.
C. Contractor certification.
D. Manufacturer's installation instructions for each product used.
E. Cured samples of exposed sealants for each color.
F. Manufacturer's Literature and Data:
1. Primers
2. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

G. Manufacturer warranty.

1.6 PROJECT CONDITIONS:

A. Environmental Limitations:
1. Do not proceed with installation of joint sealants under following conditions:

a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C (40 degrees F).

b. When joint substrates are wet.

B. Joint-Width Conditions:

1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions:

1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 DELIVERY, HANDLING, AND STORAGE:

A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.

B. Carefully handle and store to prevent inclusion of foreign materials.

C. Do not subject to sustained temperatures exceeding 32 degrees C (90 degrees F) or less than 5 degrees C (40 degrees F).

1.8 DEFINITIONS:

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

B. Backing Rod: A type of sealant backing.

C. Bond Breakers: A type of sealant backing.

D. Filler: A sealant backing used behind a back-up rod.

1.9 WARRANTY:

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

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

1.10 APPLICABLE PUBLICATIONS:

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

B. ASTM International (ASTM):

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

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

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

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

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

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

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

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

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

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

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

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

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

D1056-14.....Specification for Flexible Cellular Materials—Sponge or Expanded Rubber

E84-09.....Surface Burning Characteristics of Building Materials

C. Sealant, Waterproofing and Restoration Institute (SWRI).

1. The Professionals’ Guide

D. Environmental Protection Agency (EPA):

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

PART 2 - PRODUCTS

2.1 SEALANTS:

A. Exterior Sealants:

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

2. Horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T.

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

B. Interior Sealants:
1. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system are to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
   a. Architectural Sealants: 250 g/L.
   b. Sealant Primers for Nonporous Substrates: 250 g/L.
   c. Sealant Primers for Porous Substrates: 775 g/L.
2. Vertical and Horizontal Surfaces: ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
3. Food Service: Use a Vinyl Acetate Homopolymer, or other low VOC, non-toxic sealant approved for use in food preparation areas.
4. Provide location(s) of interior sealant as follows:
   a. Typical narrow joint 6 mm, (1/4 inch) or less at walls and adjacent components.
   b. Perimeter of doors, windows, access panels which adjoin concrete or masonry surfaces.
   c. Interior surfaces of exterior wall penetrations.
   d. Joints at masonry walls and columns, piers, concrete walls or exterior walls.
   e. Perimeter of lead faced control windows and plaster or gypsum wallboard walls.

f. Exposed isolation joints at top of full height walls.

g. Joints between bathtubs and ceramic tile; joints between shower receptors and ceramic tile; joints formed where nonplanar tile surfaces meet.

h. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.

i. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.

C. Acoustical Sealant:

1. Conforming to ASTM C919; flame spread of 25 or less; and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Acoustical sealant have a consistency of 250 to 310 when tested in accordance with ASTM D217; remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734; and be non-staining.

2. Provide location(s) of acoustical sealant as follows:

a. Exposed acoustical joint at sound rated partitions.

b. Concealed acoustic joints at sound rated partitions.

c. Joints where item pass-through sound rated partitions.

2.2 COLOR:

A. Sealants used with exposed masonry are to match color of mortar joints.

B. Sealants used with unpainted concrete are to match color of adjacent concrete.

C. Color of sealants for other locations to be light gray or aluminum, unless otherwise indicated in construction documents.

2.3 JOINT SEALANT BACKING:

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type C: Closed-cell material with a surface skin.

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056 or synthetic rubber (ASTM C509),

nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32 degrees C (minus 26 degrees F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

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

2.5 FILLER:

A. Mineral fiberboard: ASTM C612, Class 1.

B. Thickness same as joint width.

C. Depth to fill void completely behind back-up rod.

2.6 PRIMER:

A. As recommended by manufacturer of caulking or sealant material.

B. Stain free type.

2.7 CLEANERS-NON POROUS SURFACES:

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

PART 3 - EXECUTION

3.1 INSPECTION:

A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.

B. Coordinate for repair and resolution of unsound substrate materials.

C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS:

A. Prepare joints in accordance with manufacturer's instructions and SWRI (The Professionals’ Guide).

B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.

1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include but are not limited to the following:
   a. Concrete.
   b. Masonry.
   c. Unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous surfaces include but are not limited to the following:
   a. Metal.
   b. Glass.
   c. Porcelain enamel.
   d. Glazed surfaces of ceramic tile.

C. Do not cut or damage joint edges.

D. Apply non-staining masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions or as indicated by pre-construction joint sealant substrate test.
   1. Apply primer prior to installation of back-up rod or bond breaker tape.
   2. Use brush or other approved means that will reach all parts of joints. Avoid application to or spillage onto adjacent substrate surfaces.

3.3 BACKING INSTALLATION:

A. Install backing material, to form joints enclosed on three sides as required for specified depth of sealant.

B. Where deep joints occur, install filler to fill space behind the backing rod and position the rod at proper depth.

C. Cut fillers installed by others to proper depth for installation of backing rod and sealants.

D. Install backing rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.

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

3.4 SEALANT DEPTHS AND GEOMETRY:

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

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

3.5 INSTALLATION:

A. General:

1. Apply sealants and caulking only when ambient temperature is between

1.11 5 DEGREES C AND 38 DEGREES C (40 DEGREES AND 100 DEGREES F).

1.12 2. DO NOT INSTALL POLYSULFIDE BASE SEALANTS WHERE SEALANT MAY BE EXPOSED TO FUMES FROM BITUMINOUS MATERIALS, OR WHERE WATER VAPOR IN CONTINUOUS CONTACT WITH CEMENTITIOUS MATERIALS MAY BE PRESENT.

1.13 3. DO NOT INSTALL SEALANT TYPE LISTED BY MANUFACTURE AS NOT SUITABLE FOR USE IN LOCATIONS SPECIFIED.

1.14 4. APPLY CAULKING AND SEALING COMPOUND IN ACCORDANCE WITH MANUFACTURER'S PRINTED INSTRUCTIONS.

1.15 5. AVOID DROPPING OR SMEARING COMPOUND ON ADJACENT SURFACES.

1.16 6. FILL JOINTS SOLIDLY WITH COMPOUND AND FINISH COMPOUND SMOOTH.

1.17 7. TOOL EXPOSED JOINTS TO FORM SMOOTH AND UNIFORM BEDS, WITH SLIGHTLY CONCAVE SURFACE CONFORMING TO JOINT CONFIGURATION PER FIGURE 5A IN ASTM C1193 UNLESS SHOWN OR SPECIFIED OTHERWISE IN CONSTRUCTION DOCUMENTS. REMOVE MASKING TAPE IMMEDIATELY AFTER TOOLING OF SEALANT AND BEFORE SEALANT FACE STARTS TO “SKIN” OVER. REMOVE ANY EXCESS SEALANT FROM ADJACENT SURFACES OF JOINT, LEAVING THE WORKING IN A CLEAN FINISHED CONDITION.

1.18 8. FINISH PAVING OR FLOOR JOINTS FLUSH UNLESS JOINT IS OTHERWISE DETAILED.

1.19 9. APPLY COMPOUNDS WITH NOZZLE SIZE TO FIT JOINT WIDTH.

PART 2 - 10.Test sealants for compatibility with each other and substrate. Use only compatible sealant. Submit test reports.

PART 3 - 11. Replace sealant which is damaged during construction process.

PART 4 - C. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise. Take all necessary steps to prevent three-sided adhesion of sealants.

PART 5 - D. Interior Sealants: Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.

1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.

4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cutouts to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

5.2 3.6 FIELD QUALITY CONTROL:

A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
   1. Extent of Testing: Test completed elastomeric sealant joints as follows:
      a. Perform 10 tests for first 305 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
      b. Perform one test for each 305 m (1000 feet) of joint length thereafter or one test per each floor per elevation.
B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
C. Inspect tested joints and report on following:
   1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
   2. Compare these results to determine if adhesion passes sealant manufacturer’s field-adhesion hand-pull test criteria.
   3. Whether sealants filled joint cavities and are free from voids.
   4. Whether sealant dimensions and configurations comply with specified requirements.
D. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that

original sealant surfaces are clean and new sealant contacts original sealant.

F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

5.3 3.7 CLEANING:

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

B. Leave adjacent surfaces in a clean and unstained condition.

PART 6 - - - E N D - - -

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies steel studs wall systems, ceiling or soffit suspended or furred framing, wall furring, fasteners, and accessories for the screw attachment of gypsum board or other building boards.

1.2 RELATED WORK

A. Ceiling suspension systems for acoustical tile or panels and lay in gypsum board panels: Section 09 51 00, ACOUSTICAL CEILINGS: Section 09 29 00, GYPSUM BOARD.

1.3 TERMINOLOGY

A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.

B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by beams, trusses, or bar joists. In interstitial spaces with walk-on floors the underside of the walk-on floor is the underside of structure overhead.

C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

1.4 SUBMITTALS

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

B. Manufacturer's Literature and Data:

1. Studs, runners and accessories.
2. Hanger inserts.
3. Channels (Rolled steel).
4. Furring channels.
5. Screws, clips, and other fasteners.

C. Shop Drawings:

1. Typical ceiling suspension system.
2. Typical metal stud and furring construction system including details around openings and corner details.
3. Typical shaft wall assembly
4. Typical fire rated assembly and column fireproofing showing details of construction same as that used in fire rating test.

D. Test Results: Fire rating test designation, each fire rating required for each assembly.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

A. In accordance with the requirements of ASTM C754.

1.6 APPLICABLE PUBLICATIONS

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

B. ASTM International

A641-2019 Zinc-Coated (Galvanized) Carbon Steel Wire

A653/653M-2020.....Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

C11-2018.....Terminology Relating to Gypsum and Related Building Materials and Systems

C635-2017.....Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings

C636-2019.....Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels

C645-2018.....Non-Structural Steel Framing Members

C754-2020.....Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

C841-03(R2018).....Installation of Interior Lathing and Furring

C954-2018.....Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

E580-2020.....Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

PART 2 - PRODUCTS

2.1 PROTECTIVE COATING

A. Galvanize steel studs, runners (track), rigid (hat section) furring channels, "Z" shaped furring channels, and resilient furring channels, with coating designation of G40 or equivalent.

2.2 STEEL STUDS AND RUNNERS (TRACK)

A. ASTM C645, modified for thickness specified and sizes as shown.
   1. Use C 645 steel, 0.75 mm (0.0296-inch) minimum base-metal (30 mil).
   2. Runners same thickness as studs.
   3. Exception: Members that can show certified third-party testing with gypsum board in accordance with ICC ES AC86 (Approved May 2012) need not meet the minimum thickness limitation or minimum section properties set forth in ASTM C 645. The submission of an evaluation report is acceptable to show conformance to this requirement. Use C 645 steel, 0.48mm (0.019 inch) minimum base-metal (19 mil).
B. Provide not less than two cutouts in web of each stud, approximately 300 mm (12 inches) from each end, and intermediate cutouts on approximately 600 mm (24-inch) centers.
C. Doubled studs for openings and studs for supporting concrete backer-board.
D. Studs 3600 mm (12 feet) or less in length shall be in one piece.
E. Shaft Wall Framing:
   1. Conform to rated wall construction.
   2. C-H Studs or C-T Studs.
   3. E Studs.
   4. J Runners.
   5. Steel Jamb-Strut.

2.3 FURRING CHANNELS

A. Rigid furring channels (hat shape): ASTM C645.
B. Resilient furring channels:
   1. Not less than 0.45 mm (0.0179-inch) thick bare metal.
   2. Semi-hat shape, only one flange for anchorage with channel web leg slotted on anchorage side, channel web leg on other side stiffens fastener surface but shall not contact anchorage surface other channel leg is attached to.
C. "Z" Furring Channels:
   1. Not less than 0.45 mm (0.0179-inch) -thick base metal, with 32 mm (1-1/4 inch) and 19 mm (3/4-inch) flanges.
   2. Web furring depth to suit thickness of insulation.
D. Rolled Steel Channels: ASTM C754, cold rolled; or ASTM C841, cold rolled.

2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES

A. ASTM C754, except as otherwise specified.

B. For fire rated construction: Type and size same as used in fire rating test.

C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.

D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.

E. Concrete ceiling hanger inserts (anchorage for hanger wire and hanger straps): Steel, zinc-coated (galvanized), manufacturers standard items, designed to support twice the hanger loads imposed and the type of hanger used.

F. FTie Wire and Hanger Wire:

1. ASTM A641, soft temper, Class 1 coating.
2. Gage (diameter) as specified in ASTM C754 or ASTM C841.

G. Attachments for Wall Furring:

1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.
2. For concrete or masonry walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 1 mm (0.0396-inch) thick galvanized steel with corrugated edges.

H. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.

I. Web stiffener track clip:

1. Mill certified steel, ASTM A653/A653M, 68 mil.
2. Secure to wall stud framing to prevent web crippling.

2.5 SUSPENDED CEILING SYSTEM FOR GYPSUM BOARD (OPTION)

A. Conform to ASTM C635, heavy duty, with not less than 35 mm (1-3/8 inch) wide knurled capped flange face designed for screw attachment of gypsum board.

B. Wall track channel with 35 mm (1-3/8 inch) wide flange.

PART 3 - EXECUTION

3.1 INSTALLATION CRITERIA

A. Where fire rated construction is required for walls, partitions, columns, beams and floor-ceiling assemblies, the construction shall be same as that used in fire rating test.

B. Construction requirements for fire rated assemblies and materials shall be as shown and specified, the provisions of the Scope paragraph (1.2) of ASTM C754 and ASTM C841 regarding details of construction shall not apply.

3.2 INSTALLING STUDS

A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.

B. Space studs not more than 610 mm (24 inches) on center.

C. Cut studs 6 mm to 9 mm (1/4 to 3/8-inch) less than floor to underside of structure overhead when extended to underside of structure overhead.

D. Where studs are shown to terminate above suspended ceilings, provide bracing as shown or extend studs to underside of structure overhead.

E. Extend studs to underside of structure overhead for fire, rated partitions, smoke partitions, shafts, and sound rated partitions and insulated exterior wall furring.

F. Openings:

1. Frame jambs of openings in stud partitions and furring with two studs placed back-to-back or as shown.
2. Fasten back-to-back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.
3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (24 inches) on center between runner tracks.

G. Fastening Studs:

1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.

H. Chase Wall Partitions:
   1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
   2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).
I. Form building seismic or expansion joints with double studs back-to-back spaced 75 mm (three inches) apart plus the width of the seismic or expansion joint.
J. Form control joint, with double studs spaced 13 mm (1/2-inch) apart.

3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY

A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.
B. Wall furring-Stud System:
   1. Framed with 63 mm (2-1/2 inch) or narrower studs, 600 mm (24 inches) on center.
   2. Brace as specified in ASTM C754 for Wall Furring-Stud System or brace with sections or runners or studs placed horizontally at not less than three-foot vertical intervals on side without finish.
   3. Securely fasten braces to each stud with two Type S pan head screws at each bearing.
C. Direct attachment to masonry or concrete; rigid channels or "Z" channels:
   1. Install rigid (hat section) furring channels at 600 mm (24 inches) on center, horizontally or vertically.
   2. Install "Z" furring channels vertically spaced not more than 600 mm (24 inches) on center.
   3. At corners where rigid furring channels are positioned horizontally, provide mitered joints in furring channels.
   4. Ends of spliced furring channels shall be nested not less than 200 mm (8 inches).
   5. Fasten furring channels to walls with power-actuated drive pins or hardened steel concrete nails. Where channels are spliced, provide two fasteners in each flange.
   6. Locate furring channels at interior and exterior corners in accordance with wall finish material manufacturers printed erection instructions. Locate "Z" channels within 100 mm (4 inches) of corner.

D. Installing Wall Furring-Bracket System: Space furring channels not more than 400 mm (16 inches) on center.

3.4 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES

A. Provide for attachment and support of electrical outlets, plumbing, laboratory or heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers, wood seats, toilet stall partitions, dressing booth partitions, urinal screens, chalkboards, tackboards, wall-hung casework, handrail brackets, recessed fire extinguisher cabinets and other items like auto door buttons and auto door operators supported by stud construction.

B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.

3.5 INSTALLING FURRED AND SUSPENDED CEILINGS OR SOFFITS

A. Install furred and suspended ceilings or soffits in accordance with ASTM C754 or ASTM C841 except as otherwise specified or shown for screw attached gypsum board ceilings and for plaster ceilings or soffits.
   1. Space framing at 400 mm (16-inch) centers for metal lath anchorage.
   2. Space framing at 600 mm (24-inch) centers for gypsum board anchorage.

B. New exposed concrete slabs:
   1. Use metal inserts required for attachment and support of hangers or hanger wires with tied wire loops for embedding in concrete.
   2. Furnish for installation under Division 3, CONCRETE.
   3. Suspended ceilings under concrete rib construction shall have runner channels at right angles to ribs and be supported from ribs with hangers at ends and at 1200 mm (48-inch) maximum intervals along channels. Stagger hangers at alternate channels.

C. Concrete slabs on steel decking composite construction:
   1. Use pulldown tabs when available.
   2. Use power activated fasteners when direct attachment to structural framing cannot be accomplished.

D. Where bar joists or beams are more than 1200 mm (48 inches) apart, provide intermediate hangers so that spacing between supports does not exceed 1200 mm (48 inches). Use clips, bolts, or wire ties for direct attachment to steel framing.

E. Installing suspended ceiling system for gypsum board (ASTM C635 Option):
   1. Install only for ceilings to receive screw attached gypsum board.
   2. Install in accordance with ASTM C636.
      a. Install main runners spaced 1200 mm (48 inches) on center.
      b. Install 1200 mm (four foot) tees not over 600 mm (24 inches) on center; locate for edge support of gypsum board.
      c. Install wall track channel at perimeter.

F. Installing Ceiling Bracing System:
   1. Construct bracing of 38 mm (1-1/2 inch) channels for lengths up to 2400 mm (8 feet) and 50 mm (2 inch) channels for lengths over 2400 mm (8 feet) with ends bent to form surfaces for anchorage to carrying channels and overhead construction. Lap channels not less than 600 mm (2 feet) at midpoint back to back. Screw or bolt lap together with two fasteners.
   2. Install bracing at an approximate 45-degree angle to carrying channels and structure overhead; secure as specified to structure overhead with two fasteners and to carrying channels with two fasteners or wire ties.
   3. Brace suspended ceiling or soffit framing in seismic areas in accordance with ASTM E580.

3.6 TOLERANCES

A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.

B. Plumb and align vertical members within 3 mm (1/8-inch.)

C. Level or align ceilings within 3 mm (1/8-inch.)

---END---

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies installation and finishing of gypsum board.

1.2 RELATED WORK

A. A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

B. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.

C. Lay in gypsum board ceiling panels: Section 09 51 00, ACOUSTICAL CEILING.

1.3 TERMINOLOGY

A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.

B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.

C. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

1.4 SUBMITTALS

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

B. Manufacturer's Literature and Data:

1. Cornerbead and edge trim.
2. Finishing materials.
3. Laminating adhesive.
4. Gypsum board, each type.

C. Shop Drawings:

1. Typical gypsum board installation, showing corner details, edge trim details and the like.
2. Typical sound rated assembly, showing treatment at perimeter of partitions and penetrations at gypsum board.
3. Typical shaft wall assembly.
4. Typical fire rated assembly and column fireproofing, indicating details of construction same as that used in fire rating test.

D. Samples:
   1. Cornerbead.
   2. Edge trim.
   3. Control joints.

E. Test Results:
   1. Fire rating test, each fire rating required for each assembly.
   2. Sound rating test.

F. Certificates: Certify that gypsum board types, gypsum backing board types, cementitious backer units, and joint treating materials do not contain asbestos material.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

A. In accordance with the requirements of ASTM C840.

1.6 ENVIRONMENTAL CONDITIONS

A. In accordance with the requirements of ASTM C840.

1.7 APPLICABLE PUBLICATIONS

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

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

C11-15.....Terminology Relating to Gypsum and Related Building Materials and Systems

C475-15.....Joint Compound and Joint Tape for Finishing Gypsum Board

C840-13.....Application and Finishing of Gypsum Board

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

C954-15.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness

C1002-14.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

C1047-14.....Accessories for Gypsum Wallboard and Gypsum Veneer Base

C1177-13.....Glass Mat Gypsum Substrate for Use as Sheathing

C1178/C1178M-18.....Specification for Coated Glass Mat Water Resistant Backing Panel

C1658-13.....Glass Mat Gypsum Panels

C1396-14.....Gypsum Board

C. Underwriters Laboratories Inc. (UL):

Latest Edition.....Fire Resistance Directory

D. Inchcape Testing Services (ITS):

Latest Editions.....Certification Listings

PART 2 - PRODUCTS

2.1 GYPSUM BOARD

A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise.

B. Coreboard or Shaft Wall Liner Panels.

1. ASTM C1396, Type X.
2. ASTM C1658: Glass Mat Gypsum Panels,
3. Coreboard for shaft walls 300, 400, 600 mm (12, 16, or 24 inches) wide by required lengths 25 mm (one inch) thick with paper faces treated to resist moisture.

C. Water Resistant Gypsum Backing Board: ASTM C1178, Type X, 16 mm (5/8 inch) thick.

D. Paper facings shall contain 100 percent post-consumer recycled paper content.

2.2 GYPSUM SHEATHING BOARD

A. ASTM C1396, Type X, water-resistant core, 16 mm (5/8 inch) thick.

B. ASTM C1177, Type X.

2.3 ACCESSORIES

A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.

B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

2.4 FASTENERS

A. ASTM C1002 and ASTM C840, except as otherwise specified.

B. ASTM C954, for steel studs thicker than 0.04 mm (0.33 inch).

C. Select screws of size and type recommended by the manufacturer of the material being fastened.

D. For fire rated construction, type and size same as used in fire rating test.

E. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

2.5 FINISHING MATERIALS AND LAMINATING ADHESIVE

ASTM C475 and ASTM C840. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

PART 3 - EXECUTION

3.1 GYPSUM BOARD HEIGHTS

A. Extend all layers of gypsum board from floor to underside of structure overhead on following partitions and furring:

1. Two sides of partitions:
   a. Fire rated partitions.
   b. Smoke partitions.
   c. Sound rated partitions.
   d. Full height partitions shown (FHP).
   e. Corridor partitions.
2. One side of partitions or furring:
   a. Inside of exterior wall furring or stud construction.
   b. Room side of room without suspended ceilings.
   c. Furring for pipes and duct shafts, except where fire rated shaft wall construction is shown.
3. Extend all layers of gypsum board construction used for fireproofing of columns from floor to underside of structure overhead, unless shown otherwise.

B. In locations other than those specified, extend gypsum board from floor to heights as follows:

1. Not less than 100 mm (4 inches) above suspended acoustical ceilings.
2. At ceiling of suspended gypsum board ceilings.
3. At existing ceilings.

3.2 INSTALLING GYPSUM BOARD

A. Coordinate installation of gypsum board with other trades and related work.

B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.

C. Moisture and Mold-Resistant Assemblies: Provide and install moisture and mold-resistant glass mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1658 where shown and in locations which might be subject to moisture exposure during construction.

D. Use gypsum boards in maximum practical lengths to minimize number of end joints.

E. Bring gypsum board into contact, but do not force into place.

F. Ceilings:

1. For single-ply construction, use perpendicular application.
2. For two-ply assembles:
   a. Use perpendicular application.
   b. Apply face ply of gypsum board so that joints of face ply do not occur at joints of base ply with joints over framing members.

G. Walls (Except Shaft Walls):

1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.
2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (12 inches) on center in field and along edges.
3. Stagger screws on abutting edges or ends.
4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints except gypsum board shall be applied vertically over "Z" furring channels.
5. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
6. For three-ply gypsum board assemblies, apply plies in same manner as for two-ply assemblies, except that heads of fasteners need only be driven flush with surface for first and second plies. Apply third ply of wallboard in same manner as second ply of two-ply assembly, except use fasteners of sufficient length enough to have

the same penetration into framing members as required for two-ply assemblies.

7. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply or three-ply application requirements.
8. Installing Two Layer Assembly Over Sound Deadening Board:
   a. Apply face layer of wallboard vertically with joints staggered from joints in sound deadening board over framing members.
   b. Fasten face layer with screw, of sufficient length to secure framing, spaced 300 mm (12 inches) on center around perimeter, and 400 mm (16 inches) on center in the field.
9. Control Joints ASTM C840 and as follows:
   a. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout.
   b. Not required for wall lengths less than 9000 mm (30 feet).
   c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.

H. Acoustical or Sound Rated Partitions, Fire and Smoke Partitions:
1. Cut gypsum board for a space approximately 3 mm to 6 mm (1/8 to 1/4 inch) wide around partition perimeter.
2. Coordinate for application of caulking or sealants to space prior to taping and finishing.
3. For sound rated partitions, use sealing compound (ASTM C919) to fill the annular spaces between all receptacle boxes and the partition finish material through which the boxes protrude to seal all holes and/or openings on the back and sides of the boxes. STC minimum values as shown.

I. Electrical and Telecommunications Boxes:
1. Seal annular spaces between electrical and telecommunications receptacle boxes and gypsum board partitions.

J. Accessories:
1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
2. Install in one piece, without the limits of the longest commercially available lengths.

3. Corner Beads:
   a. Install at all vertical and horizontal external corners and where shown.
   b. Use screws only. Do not use crimping tool.
4. Edge Trim (casings Beads):
   a. At both sides of expansion and control joints unless shown otherwise.
   b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.
   c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.
   d. Where shown.

2.6 INSTALLING GYPSUM SHEATHING

A. Install in accordance with ASTM C840, except as otherwise specified or shown.
B. Use screws of sufficient length to secure sheathing to framing.
C. Space screws 9 mm (3/8 inch) from ends and edges of sheathing and 200 mm (8 inches) on center. Space screws a maximum of 200 mm (8 inches) on center on intermediate framing members.
D. Apply 600 mm by 2400 mm (2 foot by 8 foot) sheathing boards horizontally with tongue edge up.
E. Apply 1200 mm by 2400 mm or 2700 mm (4 ft. by 8 ft. or 9 foot) gypsum sheathing boards vertically with edges over framing.

2.7 CAVITY SHAFT WALL

A. Coordinate assembly with Section 09 22 16, NON-STRUCTURAL METAL FRAMING, for erection of framing and gypsum board.
B. Conform to UL Design No. U438 or FM WALL CONSTRUCTION 12-2/HR (Nonbearing for two-hour fire rating. Conform to FM WALL CONSTRUCTION 25-1/HR (Non-loadbearing) for one-hour fire rating where shown.
C. Cut coreboard (liner) panels 25 mm (one inch) less than floor-to-ceiling height, and erect vertically between J-runners on shaft side.
   1. 1. Where shaft walls exceed 4300 mm (14 feet) in height, position panel end joints within upper and lower third points of wall.
   2. Stagger joints top and bottom in adjacent panels.

3. After erection of J-struts of opening frames, fasten panels to J-struts with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.

D. Gypsum Board:

1. Two-hour wall:
   a. Erect base layer (backing board) vertically on finish side of wall with end joints staggered. Fasten base layer panels to studs with 25 mm (one inch) long screws, spaced 600 mm (24 inches) on center.
   b. Use laminating adhesive between plies in accordance with UL or FM if required by fire test.
   c. Apply face layer of gypsum board required by fire test vertically over base layer with joints staggered and attach with screws of sufficient length to secured to framing staggered from those in base, spaced 300 mm (12 inches) on center.
2. One hour wall with one layer on finish side of wall: Apply face layer of gypsum board vertically. Attach to studs with screws of sufficient length to secure framing, spaced 300 mm (12 inches) on center in field and along edges.
3. Where coreboard is covered with face layer of gypsum board, stagger joints of face layer from those in the coreboard base.

E. Treat joints, corners, and fasteners in face layer as specified for finishing of gypsum board.

F. Elevator Shafts:

1. Protrusions including fasteners other than flange of shaft wall framing system or offsets from vertical alignments more than 3 mm (1/8-inch) are not permitted unless shown.
2. Align shaft walls for plumb vertical flush alignment from top to bottom of shaft.

2.8 FINISHING OF GYPSUM BOARD

A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 4 finish for al finished areas open to public view.

B. Before proceeding with installation of finishing materials, assure the following:

1. Gypsum board is fastened and held close to framing or furring.

2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.

C. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of non-decorated smoke barrier, fire rated, and sound rated gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the smoke barrier, fire rated, and sound rated construction/ Sanding is not required of non-decorated surfaces.

2.9 REPAIRS

A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including nondecorated surfaces.

B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.

C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.

D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non-decorated surface to provide smoke tight construction fire protection equivalent to the fire rated construction and STC equivalent to the sound rated construction.

2.10 UNACCESSIBLE CEILINGS

A. At Mental Health and Behavioral Nursing Units, areas accessible to patients and not continuously observable by staff (e.g., patient bedrooms, day rooms), ceilings should be a solid material such as gypsum board. This will limit patient access. Access doors are needed to access electrical and mechanical equipment above the ceiling. These doors should be locked to prevent unauthorized access and secured to ceiling using tamper resistant fasteners.

- - - E N D - - -

---INTENTIONALLY BLANK---

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical units.
2. Metal ceiling suspension system for acoustical ceilings.
3. Adhesive application.

1.2 RELATED REQUIREMENTS

A. Ceiling Suspension System: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

B. Lay in gypsum board ceiling panels: Section 09 29 00, GYPSUM BOARD.

1.3 APPLICABLE PUBLICATIONS

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

B. ASTM International (ASTM):

1. A641/A641M-09a(2014) - Zinc-coated (Galvanized) Carbon Steel Wire.
2. A653/A653M-15e1 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process.
3. C423-09a - Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
4. C634-13 - Terminology Relating to Environmental Acoustics.
5. C635/C635M-13a - Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
6. C636/C636M-13 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
7. D1779-98(2011) - Adhesive for Acoustical Materials.
8. E84-15b - Surface Burning Characteristics of Building Materials.
9. E119-16 - Fire Tests of Building Construction and Materials.
10. E413-16 - Classification for Rating Sound Insulation.
11. E580/E580M-14 - Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.
12. E1264-14 - Classification for Acoustical Ceiling Products.

C. International Organization for Standardization (ISO):

1. ISO 14644-1 - Classification of Air Cleanliness.

1.4 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.

1.5 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.

1.6 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight conditioned facility.
B. Protect products from damage during handling and construction operations.

1.7 FIELD CONDITIONS

A. Environment:
   1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.
   2. Work Area Ambient Conditions: HVAC systems are complete, operational, and maintaining facility design operating conditions continuously, beginning 48 hours before installation until Government occupancy.
   3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.

1.8 WARRANTY

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

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Ceiling System: Acoustical ceilings units on existing exposed suspension systems.

2.2 SYSTEM PERFORMANCE

A. Design product complying with specified performance:
   1. Maximum Deflection: 1/360of span, maximum.
B. Surface Burning Characteristics: When tested according to ASTM E84.
   1. Flame Spread Rating: 25 maximum.

2. Smoke Developed Rating: 450 maximum.

2.3 PRODUCTS - GENERAL

A. Basis of Design: Replace and match existing adjacent ceiling tiles in color, style, pattern and texture as required.

B. Provide acoustical units from one manufacturer.

1. Provide each product exposed to view from one production run.

C. Provide suspension system from same manufacturer.

D. Sustainable Construction Requirements:

1. Mineral Base Recycled Content: 65 percent, post-consumer recycled content, minimum. Select products with recycled content to achieve overall Project recycled content requirement.
2. Steel Recycled Content: 30 percent total recycled content, minimum.
3. Aluminum Recycled Content: 50 percent total recycled content, minimum.
4. Biobased Content: 37 percent by weight biobased material, minimum.

2.4 ACOUSTICAL UNITS

A. General:

1. Ceiling Panel and Tile: ASTM E1264, bio-based content according to USDA Bio-Preferred Product requirements.
   a. Mineral Fiber: 3.6 kg/sq. m (3/4 psf) weight, minimum.
2. Classification: Provide type and form as follows:
   a. Type III Units - Mineral base with water-based painted finish maximum 10 g/l VOC; Form 2 - Water felted, minimum 16 mm (5/8 inch) thick.
   b. Type IV Units - Mineral base with membrane-faced overlay, Form 2 - Water felted, minimum 16 mm (5/8 inch) thick. Apply factory-applied latex paint over paint coat. Mold, mildew and bacteria-resistant surface. Washable and scrubbable with long lasting water-repellency
   c. Type V Units - Perforated steel facing (pan) with mineral or glass fiber base backing.
      1) Steel: Galvanized steel, ASTM A653, with G30 coating. minimum 0.38 mm (0.015 inch) thick.
      2) Bonderize both sides. Apply two coats of baked-on enamel finish on surfaces exposed to view and one coat on concealed surfaces.

d. Type VI Units - Perforated stainless steel facing (pan) with mineral or glass fiber base backing.
e. Type VII Units - Perforated aluminum facing (pan) with mineral or glass fiber base backing.
   1) Aluminum sheets, minimum 0.635 mm (0.025 inch) thick.
   2) Apply two coats of baked-on enamel finish, free from gloss or sheen, on face and flanges.
f. NRC (Noise Reduction Coefficient): ASTM C423, minimum 0.55 unless specified otherwise.
g. CAC (Ceiling Attenuation Class): ASTM E413, 40-44 range unless specified otherwise.
h. LR (Light Reflectance): Minimum 0.75.

3. Lay-in panels: Replace as required, with square edges or revel edges - style to match existing adjacent.

B. SPECIAL FACED ACOUSTICAL TILE UNITS AT(SP): Anti-microbial coated surfaces suitable for use in Class 5 Clean Rooms per ISO 14644-1. Special faced acoustical tile units shall meet all general requirements stated in this specification.

1. Type IV Units - Mineral base with membrane-faced overlay, Form 2 - Water felted, minimum 16 mm (5/8 inch) thick. Apply factory-applied latex paint over paint coat. Mold, mildew and bacteria-resistant surface. Washable and scrubbable with long lasting water-repellency.
2. Type XX-A Units - Perforated Ceramic Units for Wet Service.
   a. Mineral wool material, fired in kiln to produce a stable panel, totally unaffected by moisture when submerged in water.
   b. No damage when subjected to 10 cycles of steam at 135 degrees C (275 degrees F) and cooling to 10 degrees C (50 degrees F).
   c. Minimum of 16 mm (5/8 inch) thick.
   d. Not affected when immersed in five percent chlorine solution, except for paint finish.
3. Type III-A Units - Mineral base with painted finish.
   a. Form 1, modular, cast or molded.
   b. NRC: 0.75 minimum.
   c. Thickness: 19 mm (3/4 inch) minimum.
   d. Weight, 4.9 kg/sq. m (one pound per square foot).
4. Type XX-B Units - Combination mineral base and glass fiber with fabric finish.

a. Back Half of Panel: Perforated water felted mineral fiber.

b. Face Half of Panel: Glass fiber with glass cloth face.

c. NRC: 0.75 minimum.

d. Thickness: 28 mm (1 1/8 inches) minimum.

2.5 METAL SUSPENSION SYSTEM

A. General: ASTM C635, heavy-duty system, except as otherwise specified.

1. Suspension System: Provide the following:

a. Galvanized cold-rolled steel, bonderized. Extrude aluminum.

2. Main and Cross Runner: Use same construction Do not use lighter-duty sections for cross runners.

B. Exposed Grid Suspension System: Support of lay-in panels.

1. Grid Width: 22 mm (7/8 inch) minimum with8 mm (5/16 inch) minimum panel bearing surface.

2. Molding: Fabricate from the same material with same exposed width and finish.

3. Finish: Baked-on enamel flat texture finish.

a. Color: To match adjacent acoustical.

C. Suspension System Support of Metal Type V, VI, and VII Tiles:

D. Anchors and Inserts: Provide anchors or inserts to support twice the loads imposed by hangers.

1. Hanger Inserts: Steel, zinc-coated (galvanized after fabrication).

a. Nailing type option for wood forms:

1) Upper portion designed for anchorage in concrete and positioning lower portion below surface of concrete approximately 25 mm (one inch).

2) Lower portion provided with minimum 8 mm (5/16 inch) hole to permit attachment of hangers.

b. Flush ceiling insert type:

1) Designed to provide a shell covered opening over a wire loop to permit attachment of hangers and keep concrete out of insert recess.

2) Insert opening inside shell approximately 16 mm (5/8 inch) wide by 9 mm (3/8 inch) high over top of wire.

3) Wire 5 mm (3/16 inch) diameter with length to provide positive hooked anchorage in concrete.

E. Clips: Galvanized steel, designed to secure framing member in place. When required by manufacturer.

F. Wire: ASTM A641.
   1. Size:
      a. Wire Hangers: Minimum diameter 2.68 mm (0.1055 inch).
      b. Bracing Wires: Minimum diameter 3.43 mm (0.1350 inch).

2.6 ACCESSORIES

A. Adhesives: Low pollutant-emitting, water-based type recommended by adhered product manufacturer for each application.

B. Perimeter Seal: Vinyl, polyethylene or polyurethane open cell sponge material, density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.
   1. Thickness: As required to fill voids between back of wall molding and finish wall.
   2. Size: Minimum 9 mm (3/8 inch) wide strip.

C. Access Identification Markers: Colored markers with pressure sensitive adhesive on one side, paper or plastic, 6 to 9 mm (1/4 to 3/8 inch) diameter.
   1. Color Code: Provide the following color markers for service identification:

Color	Service
Red	Sprinkler System: Valves and Controls
Green	Domestic Water: Valves and Controls
Yellow	Chilled Water and Heating Water
Orange	Ductwork: Fire Dampers
Blue	Ductwork: Dampers and Controls
Black	Gas: Laboratory, Medical, Air and Vacuum

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Remove existing acoustical panels and suspension system to permit new installation.
   1. Retain existing acoustical panels and suspension system for reuse.
   2. Dispose of other removed materials.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings and product data.

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

3.3 ACOUSTICAL UNIT INSTALLATION

A. Applications:
   1. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.
B. Layout acoustical unit symmetrically, with minimum number of joints.
C. Installation:
   1. Install acoustic tiles after wet finishes have been installed and solvents have cured.
   2. Install lay-in acoustic panels in exposed grid with minimum 6 mm (1/4 inch) bearing at edges on supports.
      a. Install tile to lay level and in full contact with exposed grid.
      b. Replace cracked, broken, stained, dirty, or tile.
   3. Markers:
      a. Install color coded markers to identify the various concealed piping, mechanical, and plumbing systems.
      b. Attach colored markers to exposed grid on opposite sides of the units providing access.
      c. Attach marker on exposed ceiling surface of upward access acoustical unit.
D. Touch up damaged factory finishes.
   1. Repair painted surfaces with touch up primer.

3.4 CEILING SUSPENSION SYSTEM INSTALLATION

A. General: Install according to ASTM C636.
   1. Use direct or indirect hung suspension system or combination of both.
   2. Support a maximum area of 1.48 sq. m (16 sq. ft.) of ceiling per hanger.
   3. Prevent deflection in excess of 1/360 of span of cross runner and main runner.
   4. Provide additional hangers located at each corner of support components.
   5. Provide minimum 100 mm (4 inch) clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit,

secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown.

6. Provide main runners minimum 1200 mm (48 inches) in length.
7. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

B. Direct Hung Suspension System: ASTM C635.
1. Support main runners by hanger wires attached directly to the structure overhead.
2. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.

C. Anchorage to Structure:
1. Concrete:
   a. Install hanger inserts and wire loops required for support of hanger and bracing wire. Install hanger wires with looped ends through steel deck when steel deck does not have attachment device.
   b. Use eye pins or threaded studs with screw-on eyes in existing or already placed concrete structures to support hanger and bracing wire. Install in sides of concrete beams or joists at mid height.
2. Steel:
   a. Install carrying channels for attachment of hanger wires.
      1) Size and space carrying channels to support load within performance limit.
      2) Attach hangers to steel carrying channels, spaced four feet on center, unless area supported or deflection exceeds the amount specified.
   b. Attach carrying channels to the bottom flange of steel beams spaced not 1200 mm (4 feet) on center before fireproofing is installed. Weld or use steel clips for beam attachment.
   c. Attach hangers to bottom chord of bar joists or to carrying channels installed between the bar joists when hanger spacing prevents anchorage to joist. Rest carrying channels on top of the bottom chord of the bar joists, and securely wire tie or clip to joist.

D. Indirect Hung Suspension System: ASTM C635.
   1. Space carrying channels for indirect hung suspension system maximum 1200 mm (4 feet) on center. Space hangers for carrying channels maximum 2400 mm (8 feet) on center or for carrying channels less than 1200 mm (4 feet) or center to Ensure that specified requirements are not exceeded.
   2. Support main runners by specially designed clips attached to carrying channels.
E. Seismic Ceiling Bracing System:
   1. Install according to ASTM E580.
   2. Connect bracing wires to structure above as specified for anchorage to structure and to main runner of suspended ceiling at bottom.

3.5 CEILING TREATMENT

A. Moldings:
   1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
   2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.
B. Perimeter Seal:
   1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
   2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.
C. Existing ceiling:
   1. Where extension of existing ceilings occurs, match existing.
   2. Where acoustical units are salvaged and reinstalled or joined, use salvaged units within a space. Do not mix new and salvaged units within a space which results in contrast between old and new acoustic units.
   3. Comply with specifications for new acoustical units for new units required to match appearance of existing units.

3.6 CLEANING

A. Remove excess adhesive before adhesive sets.
B. Clean exposed surfaces. Remove contaminants and stains.

---END---

---INTENTIONALLY BLANK---

SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the painting and finishing as shown on the construction documents and/or specified herein, including, but not limited to, the following:

1. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
2. Painting of any surface not specifically mentioned to be painted herein or on construction documents, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, is to be included as though specified.

1.2 RELATED WORK

A. Section 01 35 26, SAFETY REQUIREMENTS: Activity Hazard Analysis.

B. Division 23 HEATING; VENTILATION AND AIR-CONDITIONING: Shop prime painting of steel and ferrous metals.

C. Division 26 ELECTRICAL: Shop prime painting of steel and ferrous metals.

D. Division 27 COMMUNICATIONS: Shop prime painting of steel and ferrous metals.

E. Division 28 ELECTRONIC SAFETY AND SECURITY: Shop prime painting of steel and ferrous metals.

1.3 DELIVERY AND STORAGE

A. Deliver materials to site in manufacturer's sealed container marked to show following:

1. Name of manufacturer.
2. Product type.
3. Batch number.
4. Instructions for use.
5. Safety precautions.

B. In addition to manufacturer's label, provide a label legibly printed as following:

1. Federal Specification Number, where applicable, and name of material.

2. Surface upon which material is to be applied.
3. Specify Coat Types: Prime; body; finish; etc.

C. Maintain space for storage, and handling of painting materials and equipment in a ventilated, neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.

D. Store materials at site at least 24 hours before using, at a temperature between 7 and 30 degrees C (45 and 85 degrees F).

1.4 QUALITY ASSURANCE

A. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. Submit evidence that key personnel have successfully performed surface preparation and application of coating on a minimum of three (3) similar projects within the past three (3) years.

B. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Contracting Officer Representative (COR) in writing of any anticipated problems using the coating systems as specified with substrates primed by others.

1.5 REGULATORY REQUIREMENTS

A. Paint materials are to conform to the restrictions of the local Environmental and Toxic Control jurisdiction.

1. Volatile Organic Compounds (VOC) Emissions Requirements: Field-applied paints and coatings that are inside the waterproofing system to not exceed limits of authorities having jurisdiction.
2. Lead-Based Paint:
   a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
   b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart

F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.

c. Do not use coatings having a lead content over 0.06 percent by weight of non-volatile content.

d. For lead-paint removal, see Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.

3. Asbestos: Provide materials that do not contain asbestos.

4. Chromate, Cadmium, Mercury, and Silica: Provide materials that do not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.

5. Human Carcinogens: Provide materials that do not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.

6. Use high performance acrylic paints in place of alkyd paints.

1.6 SAFETY AND HEALTH

A. Apply paint materials using safety methods and equipment in accordance with the following:

1. Comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis (AHA) as specified in Section 01 35 26, SAFETY REQUIREMENTS. The AHA is to include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

B. Safety Methods Used During Paint Application: Comply with the requirements of SSPC PA Guide 10.

C. Toxic Materials: To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

1. The applicable manufacturer’s Material Safety Data Sheets (MSDS) or local regulation.

2. 29 CFR 1910.1000.

3. ACHIH-BKLT and ACGHI-DOC, threshold limit values.

1.7 APPLICABLE PUBLICATIONS

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

B. American Conference of Governmental Industrial Hygienists (ACGIH):

ACGIH TLV-BKLT-2012.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)

ACGIH TLV-DOC-2012.....Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)

C. ASME International (ASME):

A13.1-07(R2013).....Scheme for the Identification of Piping Systems

D. Code of Federal Regulation (CFR):

40 CFR 59.....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

E. Commercial Item Description (CID):

A-A-1272A.....Plaster Gypsum (Spackling Compound)

F. Federal Specifications (Fed Spec):

TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)

G. Master Painters Institute (MPI):

1.....Aluminum Paint

3.....Primer, Alkali Resistant, Water Based

4.....Interior/ Exterior Latex Block Filler

5.....Exterior Alkyd Wood Primer

6.....Exterior, Latex for Exterior Wood Primer

7.....Exterior Oil Wood Primer

8.....Exterior Alkyd, Flat MPI Gloss Level 1

9.....Exterior Alkyd Enamel MPI Gloss Level 6

10.....Exterior Latex, Flat

11.....Exterior Latex, Semi-Gloss

15.....Exterior Latex, Low Sheen (MPI Gloss Level 3-4)

17.....Primer, Bonding, Waterbased

18.....Organic Zinc Rich Primer

22.....Aluminum Paint, High Heat (up to 590% - 1100F)

23.....Primer, Metal, Surface Tolerant

27.....Exterior / Interior Alkyd Floor Enamel, Gloss

31.....Polyurethane, Moisture Cured, Clear Gloss

36.....Knot Sealer

39.....Primer, Latex, for Interior Wood

40.....Exterior, Latex High Build
42.....Textured Coating, Latex, Flat
43.....Interior Satin Latex, MPI Gloss Level 4
44.....Interior Low Sheen Latex, MPI Gloss Level 2
45.....Interior Primer Sealer
46.....Interior Enamel Undercoat
47.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5
48.....Interior Alkyd, Gloss, MPI Gloss Level 6
50.....Interior Latex Primer Sealer
51.....Interior Alkyd, Eggshell, MPI Gloss Level 3
52.....Interior Latex, MPI Gloss Level 3
53.....Interior Latex, Flat, MPI Gloss Level 1
54.....Interior Latex, Semi-Gloss, MPI Gloss Level 5
59.....Interior/Exterior Alkyd Porch & Floor Enamel, Low Gloss
60.....Interior/Exterior Latex Porch & Floor Paint, Low Gloss
66.....Interior Alkyd Fire Retardant, Clear Top-Coat (ULC Approved)
64.....Fire Retardant Coating, Latex, Interior Flat (ULC Approved)
67.....Interior Latex Fire Retardant, Top-Coat (ULC Approved)
68.....Interior/ Exterior Latex Porch & Floor Paint, Gloss
71.....Polyurethane, Moisture Cured, Clear, Flat
77.....Epoxy Cold Cured, Gloss
79.....Marine Alkyd Metal Primer
90.....Interior Wood Stain, Semi-Transparent
91.....Wood Filler Paste
94.....Exterior Alkyd, Semi-Gloss
95.....Fast Drying Metal Primer
98.....High Build Epoxy Coating
99.....Sealer, Water-based, for Concrete Floors
101.....Epoxy Anti-Corrosive Metal Primer
107.....Primer, Rust-Inhibitive, Water-based
108.....High Build Epoxy Coating, Low Gloss

113.....Elastomeric, Pigmented, Exterior, Water-based, Flat

114.....Interior Latex, Gloss

115.....Epoxy-Modified Latex, Interior Gloss (MPI gloss level 6)

118.....Dry Fall, Latex Flat

119.....Exterior Latex, High Gloss (acrylic)

134.....Galvanized Water Based Primer

135.....Non-Cementitious Galvanized Primer

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

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

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

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

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

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

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

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

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

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

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

H. Society for Protective Coatings (SSPC):

SSPC SP 1-82(R2004).....Solvent Cleaning

SSPC SP 2-82(R2004).....Hand Tool Cleaning

SSPC SP 3-28(R2004).....Power Tool Cleaning

SSPC SP 10/NACE No.2....Near-White Blast Cleaning

SSPC PA Guide 10.....Guide to Safety and Health Requirements

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

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

29 CFR 1910.1000.....Air Contaminants

K. Underwriter's Laboratory (UL)

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents.

2.2 PAINT PROPERTIES:

A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.

B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

C. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer and use only to recommended limits.

D. VOC Content: For field applications that are inside the weatherproofing system, paints and coating to comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 gram/liter.
2. Non-flat Paints and Coatings: 150 gram/liter.
3. Dry-Fog Coatings: 400 gram/liter.
4. Primers, Sealers, and Undercoaters: 200 gram/liter.
5. Anticorrosive and Antirust Paints applied to Ferrous Metals: 250 gram/liter.
6. Zinc-Rich Industrial Maintenance Primers: 340 gram/liter.
7. Pretreatment Wash Primers: 420 gram/liter.
8. Shellacs, Clear: 730 gram/liter.
9. Shellacs, Pigmented: 550 gram/liter.

VOC test method for paints and coatings is to be in accordance with 40 CFR 59 (EPA Method 24). Part 60, Appendix A with the exempt compounds' content determined by Method 303 (Determination of Exempt Compounds) in the South Coast Air Quality Management District's

(SCAQMD) "Laboratory Methods of Analysis for Enforcement Samples" manual.

PART 3 - EXECUTION

3.1 JOB CONDITIONS:

A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.

1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each day's work.

B. Atmospheric and Surface Conditions:

1. Do not apply coating when air or substrate conditions are:
   a. Less than 3 degrees C (5 degrees F) above dew point.
   b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the COR and the product manufacturer. Under no circumstances are application conditions to exceed manufacturer recommendations.
   c. When the relative humidity exceeds 85 percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.
2. Maintain interior temperatures until paint dries hard.
3. Do no exterior painting when it is windy and dusty.
4. Do not paint in direct sunlight or on surfaces that the sun will warm.
5. Apply only on clean, dry and frost-free surfaces except as follows:
   a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces only when allowed by manufacturer's printed instructions.
   b. Concrete and masonry when permitted by manufacturer's recommendations, dampen surfaces to which water thinned acrylic and cementitious paints are applied with a fine mist of water on hot dry days to prevent excessive suction and to cool surface.
6. Varnishing:
   a. Apply varnish in clean areas and in still air.

b. Before varnishing vacuum and dust area.

c. Immediately before varnishing wipe down surfaces with a tack rag.

3.2 INSPECTION:

A. Examine the areas and conditions where painting and finishing are to be applied and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 GENERAL WORKMANSHIP REQUIREMENTS:

A. Application may be by brush or roller. Spray application only upon acceptance from the COR in writing.

B. Furnish to the COR a painting schedule indicating when the respective coats of paint for the various areas and surfaces will be completed. This schedule is to be kept current as the job progresses.

C. Protect work at all times. Protect all adjacent work and materials by suitable covering or other method during progress of work. Upon completion of the work, remove all paint and varnish spots from floors, glass and other surfaces. Remove from the premises all rubbish and accumulated materials of whatever nature not caused by others and leave work in a clean condition.

D. Remove and protect hardware, accessories, device plates, lighting fixtures, and factory finished work, and similar items, or provide in place protection. Upon completion of each space, carefully replace all removed items by workmen skilled in the trades involved.

E. When indicated to be painted, remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.

F. Materials are to be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.

G. Apply materials with coverage to hide substrate completely. When color, stain, dirt or undercoats show through final coat of paint, the surface is to be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage, at no additional cost to the Government.

H. All coats are to be dry to manufacturer’s recommendations before applying succeeding coats.

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

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

3.4 SURFACE PREPARATION:

A. General:

1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished are to be completely dry, clean and smooth.
2. See other sections of specifications for specified surface conditions and prime coat.
3. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
4. Clean surfaces before applying paint or surface treatments with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.
5. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   a. Concrete: 12 percent.
   b. Fiber-Cement Board: 12 percent.
   c. Masonry (Clay and CMU's): 12 percent.
   d. Wood: 15 percent.
   e. Gypsum Board: 12 percent.
   f. Plaster: 12 percent.

3.5 PAINT PREPARATION:

A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.

B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.

C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.

D. Mix two (2) component and two (2) part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.

E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.6 APPLICATION:

A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.

B. Unless otherwise specified, apply paint in three (3) coats; prime, body, and finish. When two (2) coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.

C. Apply each coat evenly and cover substrate completely.

D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by COR.

E. Apply by brush or roller. Spray application for new or existing occupied spaces only upon approval by acceptance from COR in writing.

1. Apply painting materials specifically required by manufacturer to be applied by spraying.
2. In new construction and in existing occupied spaces, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in “Building and Structural Work Field Painting”; “Work not Painted”; motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.

F. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

3.7 PRIME PAINTING:

A. After surface preparation, prime surfaces before application of body and finish coats, except as otherwise specified.

B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.

C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.

3.8 REFINISHING EXISTING PAINTED SURFACES:

A. Clean, patch and repair existing surfaces as specified under "Surface Preparation". No "telegraphing" of lines, ridges, flakes, etc., through new surfacing is permitted. Where this occurs, sand smooth and re-finish until surface meets with COR's approval.

B. Remove and reinstall items as specified under "General Workmanship Requirements".

C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.

D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.

E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.

F. In existing rooms and areas where alterations occur, clean existing stained and natural finished wood retouch abraded surfaces and then give entire surface one (1) coat of MPI 31 (Polyurethane, Moisture Cured, Clear Gloss) or MPI 71 (Polyurethane, Moisture Cured, Clear Flat).

G. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.

H. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.

I. Sand or dull glossy surfaces prior to painting.

J. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.9 PAINT COLOR:

A. The color and gloss of finish coats is to match adjacent.

B. Coat Colors:

1. Color of priming coat: Lighter than body coat.
2. Color of body coat: Lighter than the finish coat.
3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.

C. Painting, Caulking, Closures, and Fillers Adjacent to Casework:

1. Paint to match color of casework where casework has a paint finish.
2. Paint to match the color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.10 PROTECTION CLEAN UP, AND TOUCH-UP:

A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.

B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.

C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

- - - E N D - - -

---INTENTIONALLY BLANK---

SECTION 23 05 11
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 23.

B. Definitions:

1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
2. Exterior: Piping, ductwork, and equipment exposed to weather be it temperature, humidity, precipitation, wind, or solar radiation.

C. Abbreviations/Acronyms:

1. ac: Alternating Current
2. AC: Air Conditioning
3. ACU: Air Conditioning Unit
4. ACR: Air Conditioning and Refrigeration
5. AI: Analog Input
6. AISI: American Iron and Steel Institute
7. AO: Analog Output
8. ASJ: All Service Jacket
9. AWG: American Wire Gauge
10. BACnet: Building Automation and Control Networking Protocol
11. BAg: Silver-Copper-Zinc Brazing Alloy
12. BAS: Building Automation System
13. BCuP: Silver-Copper-Phosphorus Brazing Alloy
14. bhp: Brake Horsepower
15. Btu: British Thermal Unit
16. Btu/h: British Thermal Unit Per Hour
17. CDA: Copper Development Association
18. C: Celsius
19. CD: Compact Disk
20. CFM: Cubic Foot Per Minute
21. CH: Chilled Water Supply
22. CHR: Chilled Water Return
23. CLR: Color
24. cm: Centimeter
25. CO: Carbon Monoxide
26. COR: Contracting Officer’s Representative

27. CPD: Condensate Pump Discharge
28. CPM: Cycles Per Minute
29. CPVC: Chlorinated Polyvinyl Chloride
30. CRS: Corrosion Resistant Steel
31. CTPD: Condensate Transfer Pump Discharge
32. CTPS: Condensate Transfer Pump Suction
33. CW: Cold Water
34. CWP: Cold Working Pressure
35. CxA: Commissioning Agent
36. dB: Decibels
37. dB(A): Decibels (A weighted)
38. DDC: Direct Digital Control
39. DI: Digital Input
40. DO: Digital Output
41. DVD: Digital Video Disc
42. DN: Diameter Nominal
43. DWV: Drainage, Waste and Vent
44. EPDM: Ethylene Propylene Diene Monomer
45. EPT: Ethylene Propylene Terpolymer
46. ETO: Ethylene Oxide
47. F: Fahrenheit
48. FAR: Federal Acquisition Regulations
49. FD: Floor Drain
50. FED: Federal
51. FG: Fiberglass
52. FGR: Flue Gas Recirculation
53. FOS: Fuel Oil Supply
54. FOR: Fuel Oil Return
55. FSK: Foil-Scrim-Kraft facing
56. FWPD: Feedwater Pump Discharge
57. FWPS: Feedwater Pump Suction
58. GC: Chilled Glycol Water Supply
59. GCR: Chilled Glycol Water Return
60. GH: Hot Glycol Water Heating Supply
61. GHR: Hot Glycol Water Heating Return
62. gpm: Gallons Per Minute
63. HDPE: High Density Polyethylene

64. Hg: Mercury
65. HOA: Hands-Off-Automatic
66. hp: Horsepower
67. HPS: High Pressure Steam (414 kPa (60 psig) and above)
68. HPR: High Pressure Steam Condensate Return
69. HW: Hot Water
70. HWH: Hot Water Heating Supply
71. HWHR: Hot Water Heating Return
72. Hz: Hertz
73. ID: Inside Diameter
74. IPS: Iron Pipe Size
75. kg: Kilogram
76. kPa: Kilopascal
77. KPH: Kilometers Per Hour
78. lb: Pound
79. lb/hr: Pounds Per Hour
80. L/s: Liters Per Second
81. L/min: Liters Per Minute
82. LPS: Low Pressure Steam (103 kPa (15 psig) and below)
83. LPR: Low Pressure Steam Condensate Gravity Return
84. MAWP: Maximum Allowable Working Pressure
85. MAX: Maximum
86. MBH: 1000 Btu/h
87. MBtu/h: 1000 Btu/h
88. MBtu: 1000 Btu
89. MED: Medical
90. m: Meter
91. MFG: Manufacturer
92. mg: Milligram
93. mg/L: Milligrams Per Liter
94. MIN: Minimum
95. MJ: Megajoules
96. ml: Milliliter
97. Mlb: 1000 lb
98. mm: Millimeter
99. MPH: Miles Per Hour

100. MPS: Medium Pressure Steam (110 kPa (16 psig) through 414 kPa (60 psig))
101. MPR: Medium Pressure Steam Condensate Return
102. MW: Megawatt
103. NC: Normally Closed
104. NF: Oil Free Dry (Nitrogen)
105. Nm: Newton Meter
106. NO: Normally Open
107. NOx: Nitrous Oxide
108. NPT: National Pipe Thread
109. NPS: Nominal Pipe Size
110. OD: Outside Diameter
111. OSD: Open Sight Drain
112. OS&Y: Outside Stem and Yoke
113. PC: Pumped Condensate
114. PID: Proportional-Integral-Differential
115. PLC: Programmable Logic Controllers
116. PP: Polypropylene
117. PPE: Personal Protection Equipment
118. ppb: Parts Per Billion
119. ppm: Parts Per Million
120. PRV: Pressure Reducing Valve \
121. PSIA: Pounds Per Square Inch Absolute
122. psig: Pounds Per Square Inch Gauge
123. PTFE: Polytetrafluoroethylene
124. PVC: Polyvinyl Chloride
125. PVDC: Polyvinylidene Chloride Vapor Retarder Jacketing, White
126. PVDF: Polyvinylidene Fluoride
127. rad: Radians
128. RH: Relative Humidity
129. RO: Reverse Osmosis
130. rms: Root Mean Square
131. RPM: Revolutions Per Minute
132. RS: Refrigerant Suction
133. RTD: Resistance Temperature Detectors
134. RTRF: Reinforced Thermosetting Resin Fittings
135. RTRP: Reinforced Thermosetting Resin Pipe

136. SCFM: Standard Cubic Feet Per Minute
137. SPEC: Specification
138. SPS: Sterile Processing Services
139. STD: Standard
140. SDR: Standard Dimension Ratio
141. SUS: Saybolt Universal Second
142. SW: Soft water
143. SWP: Steam Working Pressure
144. TAB: Testing, Adjusting, and Balancing
145. TDH: Total Dynamic Head
146. TEFC: Totally Enclosed Fan-Cooled
147. TFE: Tetrafluoroethylene
148. THERM: 100,000 Btu
149. THHN: Thermoplastic High-Heat Resistant Nylon Coated Wire
150. THWN: Thermoplastic Heat & Water-Resistant Nylon Coated Wire
151. T/P: Temperature and Pressure
152. USDA: U.S. Department of Agriculture
153. V: Volt
154. VAC: Vacuum
155. VA: Veterans Administration
156. VAC: Voltage in Alternating Current
157. VA CFM: VA Construction & Facilities Management
158. VA CFM CSS: VA Construction & Facilities Management, Consulting Support Service
159. VAMC: Veterans Administration Medical Center
160. VHA OCAMES: Veterans Health Administration – Office of Capital Asset Management Engineering and Support
161. VR: Vacuum condensate return
162. WCB: Wrought Carbon Steel, Grade B
163. WG: Water Gauge or Water Column
164. WOG: Water, Oil, Gas

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
C. Section 07 84 00, FIRESTOPPING.
D. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.
E. Section 23 07 11, HVAC AND BOILER PLANT INSULATION.

F. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

G. Section 23 36 00, AIR TERMINAL UNITS.

H. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

I. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.

B. Air Movement and Control Association (AMCA):

410-1996.....Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans

C. American Society of Mechanical Engineers (ASME):

B31.1-2020.....Power Piping

B31.9-2020.....Building Services Piping

ASME Boiler and Pressure Vessel Code:

BPVC Section IX-2023 Welding, Brazing, and Fusing Qualifications

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

A36/A36M-2019.....Standard Specification for Carbon Structural Steel

A575-1996(R2018).....Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades

E. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc.:

SP-58-2018.....Pipe Hangers and Supports-Materials, Design, Manufacture, Selection, Application, and Installation

F. Military Specifications (MIL):

MIL-P-21035B-2013.....Paint High Zinc Dust Content, Galvanizing Repair (Metric)

G. National Fire Protection Association (NFPA):

70-2023.....National Electrical Code (NEC)

101-2021.....Life Safety Code

H. Department of Veterans Affairs (VA):

PG-18-10-2023.....Physical Security and Resiliency Design Manual

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 05 11, COMMON WORK RESULTS FOR HVAC", with applicable paragraph identification.

C. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements, and all equipment that requires regular maintenance, calibration, etc are accessable from the floor or permanent work platform. It is the Contractor's responsibility to ensure all submittals meet the VA specifications and requirements and it is assumed by the VA that all submittals do meet the VA specifications unless the Contractor has requested a variance in writing and approved by COR prior to the submittal. If at any time during the project it is found that any item does not meet the VA specifications and there was no variance approval the Contractor shall correct at no additional cost or time to the Government even if a submittal was approved.

D. If equipment is submitted which differs in arrangement from that shown, provide documentation proving equivalent performance, design standards and drawings that show the rearrangement of all associated systems. Additionally, any impacts on ancillary equipment or services such as foundations, piping, and electrical shall be the Contractor's responsibility to design, supply, and install at no additional cost or time to the Government. VA approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

E. Prior to submitting shop drawings for approval, Contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed contract documents and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

F. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together.

Coordinate and properly integrate materials and equipment to provide a completely compatible and efficient installation.

G. Coordination/Shop Drawings:

1. Submit complete consolidated and coordinated shop drawings for all new systems, and for existing systems that are in the same areas.
2. The coordination/shop drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8-inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance. Provide detailed coordination/shop drawings of all piping and duct systems. The drawings should include all lockout/tagout points for all energy/hazard sources for each piece of equipment. Coordinate lockout/tagout procedures and practices with local VA requirements.
3. Do not install equipment foundations, equipment or piping until coordination/shop drawings have been approved.
4. In addition, for HVAC systems, provide details of the following:
   a. Mechanical equipment rooms.
   b. Hangers, inserts, supports, and bracing.
   c. Pipe sleeves.
   d. Duct or equipment penetrations of floors, walls, ceilings, or roofs.

H. Manufacturer's Literature and Data: Include full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity. Submit under the pertinent section rather than under this section.

1. Submit belt drive with the driven equipment. Submit selection data for specific drives when requested by the COR.
2. Submit electric motor data and variable speed drive data with the driven equipment.
3. Equipment and materials identification.

4. Fire-stopping materials.
5. Hangers, inserts, supports and bracing. Provide complete stress analysis for variable spring and constant support hangers.
6. Wall, floor, and ceiling plates.

I. HVAC Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
2. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
   a. Include complete list indicating all components of the systems.
   b. Include complete diagrams of the internal wiring for each item of equipment.
   c. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
3. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

J. Provide copies of approved HVAC equipment submittals to the TAB Subcontractor.

1.5 QUALITY ASSURANCE

A. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in industrial and institutional HVAC.

B. Equipment Vibration Tolerance:

1. Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT. Equipment shall be factory-balanced to this tolerance and re-balanced on site, as necessary.

2. After HVAC air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.

C. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years (or longer as specified elsewhere). The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions and/or additional requirements.
2. Refer to all other sections for quality assurance requirements for systems and equipment specified therein.
3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. The products and execution of work specified in Division 23 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments shall be enforced, along with requirements of local utility companies. The most stringent requirements of these specifications, local codes, or utility company requirements shall always apply. Any conflicts shall be brought to the attention of the COR.
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be of the same manufacturer and model number, or if different models are required, they shall be of the same manufacturer and identical to the greatest extent possible (i.e., same model series).
6. Assembled Units: Performance and warranty of all components that make up an assembled unit shall be the responsibility of the manufacturer of the completed assembly.

7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
8. Use of asbestos products or equipment or materials containing asbestos is prohibited.

D. HVAC Equipment Service Providers: Service providers shall be authorized and trained by the manufacturers of the equipment supplied. These providers shall be capable of responding onsite and provide acceptable service to restore equipment operations within 4 hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shutdown of equipment; or within 24 hours in a non-emergency. Submit names, mail and e-mail addresses and phone numbers of service personnel and companies providing service under these conditions for (as applicable to the project): fans, air handling units, chillers, cooling towers, control systems, pumps, critical instrumentation, computer workstation and programming.

E. HVAC Mechanical Systems Welding: Before any welding is performed, Contractor shall submit a certificate certifying that welders comply with the following requirements:
1. Qualify welding processes and operators for piping according to ASME BPVC Section IX. Provide proof of current certification.
2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
3. Certify that each welder and welding operator has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
4. All welds shall be stamped according to the provisions of the AWS or ASME as required herein and by the associated code.

F. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the COR with submittals. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations

can be cause for rejection of the material and removal by the Contractor and no additional cost or time to the Government.

G. Execution (Installation, Construction) Quality:

1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract documents to the COR for resolution. Provide written hard copies and computer files on CD or DVD of manufacturer’s installation instructions to the COR with submittals prior to commencing installation of any item. Installation of the item will not be allowed to proceed until the recommendations are received and approved by the VA. Failure to furnish these recommendations is a cause for rejection of the material.
2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include, but are not limited to, all types of valves, filters and strainers, transmitters, control devices. Prior to commencing installation work, refer conflicts between this requirement and contract documents to the COR for resolution. Failure of the Contractor to resolve or point out any issues will result in the Contractor correcting at no additional cost or time to the Government.
3. Complete coordination/shop drawings shall be required in accordance with Article, SUBMITTALS. Construction work shall not start on any system until the coordination/shop drawings have been approved by VA.
4. Workmanship/craftsmanship will be of the highest quality and standards. The VA reserves the right to reject any work based on poor quality of workmanship this work shall be removed and done again at no additional cost or time to the Government.

H. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with current telephone numbers and e-mail addresses.

I. Guaranty: Warranty of Construction, FAR Clause 52.246-21.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage or theft.
2. Large equipment such as boilers, chillers, cooling towers, fans, and air handling units if shipped on open trailer trucks shall be covered with shrink on plastics or water proof tarpaulins that provide protection from exposure to rain, road salts and other transit hazards. Protection shall be kept in place until equipment is moved into a building or installed as designed.
3. Repair damaged equipment in first class, new operating condition and appearance; or, replace same as determined and directed by the COR. Such repair or replacement shall be at no additional cost or time to the Government.
4. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
5. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.
6. Protect plastic piping and tanks from ultraviolet light (sunlight).

B. Cleanliness of Piping and Equipment Systems:

1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. Clean interior of all tanks prior to delivery for beneficial use by the Government.
4. Boilers shall be left clean following final internal inspection by Government insurance representative or inspector.

5. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.7 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, VA approved substitutions and construction revisions shall be in electronic version on CD or DVD inserted into a three-ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing Contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. Should the installing Contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:

1. Red-lined, hand-marked drawings are to be provided, with one paper copy and a scanned PDF version of the hand-marked drawings provided on CD or DVD.

D. The as-built drawings shall indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc. Coordinate lockout/tagout procedures and practices with local VA requirements.

E. Certification documentation shall be provided to COR 21 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals

performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results shall contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results shall include all readings, including but not limited to data on device (make, model and performance characteristics_), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

1.8 JOB CONDITIONS – WORK IN EXISTING BUILDING

A. Building Operation: Government employees will be continuously operating and managing all facilities, including temporary facilities that serve the VAMC.

B. Maintenance of Service: Schedule all work to permit continuous service as required by the VAMC.

C. Steam and Condensate Service Interruptions: Limited steam and condensate service interruptions, as required for interconnections of new and existing systems, will be permitted by the COR during periods when the demands are not critical to the operation of the VAMC. These non-critical periods are limited to between 8 pm and 5 am in the appropriate off-season (if applicable). Provide at least 10 working days advance notice to the COR. The request shall include a detailed plan on the proposed shutdown and the intended work to be done along with manpower levels. All equipment and materials must be onsite and verified with plan 5 days prior to the shutdown or it will need to be rescheduled.

D. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Maintain the interior of building at 18 degrees C (65 degrees F) minimum. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. Storm water or ground water leakage is prohibited. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all equipment being operated by VA. Maintain all egress routes and safety systems/devices.

E. Acceptance of Work for Government Operation: As new equipment, systems and facilities are made available for operation and these items are deemed of beneficial use to the Government, inspections will be made, and tests will be performed. Based on the inspections, a list of contract deficiencies will be issued to the Contractor. After correction of deficiencies as necessary for beneficial use, the Contracting Officer will process necessary acceptance and the equipment will then be under the control and operation of Government personnel.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Provide maximum standardization of components to reduce spare part requirements.

B. Performance and warranty of all components that make up an assembled unit shall be the responsibility of the manufacturer of the completed assembly.

1. All components of an assembled unit need not be products of same manufacturer.
2. Constituent parts that are alike shall be products of a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for intended service.
4. Contractor shall guarantee performance of assemblies of components and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

C. Equipment and components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a nameplate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, must be the same make and model. Exceptions must be approved by the VA but may be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational plant that conforms to contract requirements.

2.3 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown on the contract documents and shown in the maintenance manuals. Identification for piping is specified in Section 09 91 00, PAINTING.

B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 5 mm (3/16 inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.

C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 5 mm (3/16 inch) high riveted or bolted to the equipment.

D. Control Items: Label all instrumentation, temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.

E. Valve Tags and Lists:

1. HVAC and Mechanical Rooms: Provide for all valves other than for equipment in Section 23 36 00, AIR TERMNAL UNITS.
2. Valve tags: Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 6 mm (1/4 inch) for service designation on 19-gauge 40 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
3. Valve lists: Typed or printed plastic coated card(s), sized 215 mm (8-1/2 inches) by 275 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
4. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color-coded thumb tack in ceiling.

F. Ceiling Grid Labels:

1. 50 mm (2 inch) long by 15 mm (1/2 inch) wide by 0.025 mm (1 mil) thick UV resistant metalized polyester label with red border color and black custom lettering on white background interior. Peel and stick adhesive backing. Label and adhesive manufactured specifically for use in equipment inventory tagging.
2. Custom print labels with above ceiling HVAC equipment numbers.

2.4 FIRESTOPPING

A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping and ductwork. Refer to Section 23 07 11, HVAC AND BOILER PLANT INSULATION, for firestop pipe and duct insulation.

2.5 GALVANIZED REPAIR COMPOUND

A. Mil-P-21035B, paint form.

2.6 HVAC PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. Vibration Isolators: Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

B. Supports for Roof Mounted Items:

1. Equipment: Equipment rails shall be galvanized steel, minimum 1.3 mm (18 gauge), with integral baseplate, continuous welded corner seams, factory installed 5 by 10 cm (2 by 4 inches) treated wood nailer, 1.3 mm (18 gauge) galvanized steel counter flashing cap with screws, built-in cant strip, (except for gypsum or tectum deck), minimum height 27.5 cm (11 inches). For surface insulated roof deck, provide raised cant strip to start at the upper surface of the insulation.
2. Pipe/duct pedestals: Provide a galvanized Unistrut channel welded to U-shaped mounting brackets which are secured to side of rail with galvanized lag bolts.

C. Pipe Supports: Comply with MSS SP-58. Type Numbers specified refer to this standard. For selection and application comply with MSS SP-58.

D. Attachment to Concrete Building Construction:

1. Concrete insert: MSS SP-58, Type 18.
2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 10 cm (4 inches) thick when approved by the COR for each job condition.

3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 10 cm (4 inches) thick when approved by the COR for each job condition.

E. Attachment to Steel Building Construction:
1. Welded attachment: MSS SP-58, Type 22.
2. Beam clamps: MSS SP-58, Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8 inch) outside diameter.

F. Attachment to existing structure: Support from existing floor/roof frame.

G. Hanger Rods: Hot-rolled steel, ASTM A36/A36M or ASTM A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 40 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

2.7 DUCT PENETRATIONS

A. Provide curbs for roof mounted piping, ductwork and equipment. Curbs shall be 45 cm (18 inches) high with continuously welded seams, built-in cant strip, interior baffle with acoustic insulation, curb bottom, hinged curb adapter.

B. Provide firestopping for openings through fire and smoke barriers, maintaining minimum required rating of floor, ceiling or wall assembly. See Section 07 84 00, FIRESTOPPING.

2.8 SPECIAL TOOLS AND LUBRICANTS

A. Furnish, and turn over to the COR, tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Refrigerant Tools: Provide system charging/Evacuation equipment, gauges, fittings, and tools required for maintenance of furnished equipment.

D. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the COR.

E. Lubricants: A minimum of 1 L (1 quart) of oil, and 1/2 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in

unopened containers and properly identified as to use for each different application.

2.9 WALL, FLOOR AND CEILING PLATES

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

B. Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025 inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035 inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

2.10 ASBESTOS

A. Materials containing asbestos are prohibited.

PART 3 - EXECUTION

3.1 GENERAL

A. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. The coordination/shop drawings shall be submitted for review. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Equipment coordination/shop drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices.

All gauges and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the contract documents.

C. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.

D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

E. Cutting Holes:

1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill is prohibited, except as permitted by COR where working area space is limited.
2. Locate holes to avoid interference with structural members such as slabs, columns, ribs, beams or reinforcing. Holes shall be laid out in advance and drilling done only after approval by COR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to COR for approval.
3. Do not penetrate membrane waterproofing.

F. Electrical Interconnection of Instrumentation or Controls: This generally not shown but must be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Devices shall be located so they are easily accessible for testing, maintenance, calibration, etc. The COR has the final determination on what is accessible and what is not. Comply with NFPA 70.

G. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COR. Damaged or defective items in the opinion of the COR, shall be replaced.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means

of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

H. Install gauges, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gauges to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

I. Install steam piping expansion joints as per manufacturer’s recommendations.

J. Work in Existing Building:

1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.

K. Switchgear/Electrical Equipment Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and data/telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Installation of piping, ductwork, leak protection apparatus or other installations foreign to the electrical installation shall not be located in the space equal to the width and depth of the equipment and extending from to a height of 2 m (6 feet) above the equipment or to ceiling structure, whichever is lower (NFPA 70).

L. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance or inspections, equipment shall be removed, and reinstalled or remedial action performed as directed at no additional cost or time to the Government.

2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to motors, fans, pumps, belt guards, transformers, high voltage lines, conduit and raceways, piping, hot surfaces, and ductwork. The COR has final determination on whether an installation meets this requirement or not.

3.3 TEMPORARY PIPING AND EQUIPMENT

A. Continuity of operation of existing facilities will generally require temporary installation or relocation of equipment and piping.

B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of Article, ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING apply.

C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

3.4 PIPE AND EQUIPMENT SUPPORTS

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels designed by a structural engineer, secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the COR.

B. Use of chain pipe supports; wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above are prohibited. Replace or thoroughly clean rusty products and paint with zinc primer.

C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2 inch) clearance between pipe or piping covering and adjacent work.

D. Overhead Supports:
   1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
   2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
   3. Tubing and capillary systems shall be supported in channel troughs.

3.5 MECHANICAL DEMOLITION

A. Rigging access, other than indicated on the contract documents, shall be provided by the Contractor after approval for structural integrity by the COR. Such access shall be provided without additional cost or time to the Government. Where work is in an operating plant, provide approved protection from dust and debris at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.

B. In an operating facility, maintain the operation, cleanliness and safety. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Confine the work to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Debris accumulated in the area to the detriment of plant operation is prohibited. Perform all flame cutting to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. Perform all work in accordance with recognized fire protection standards. Inspection will be made by personnel of the VAMC, and Contractor shall follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.

C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work shall be completely removed from Government property per Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT. This includes all concrete pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All

openings shall be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with contract documents where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the contract documents of the other disciplines in the project for additional facilities to be demolished or handled.

D. All indicated valves including gate, globe, ball, butterfly and check, all pressure gauges and thermometers with wells shall remain Government property and shall be removed and delivered to COR and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these contract documents. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate.

3.6 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

B. In addition, the following special conditions apply:

1. Cleaning shall be thorough. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
2. The following material and equipment shall not be painted:

a. Motors, controllers, control switches, and safety switches.
b. Control and interlock devices.
c. Regulators.
d. Pressure reducing valves.
e. Control valves and thermostatic elements.
f. Lubrication devices and grease fittings.
g. Copper, brass, aluminum, stainless steel and bronze surfaces.
h. Valve stems and rotating shafts.
i. Pressure gauges and thermometers.
j. Glass.
k. Nameplates.

3. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.
4. Pumps, motors, steel and cast-iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same paint type and color as utilized by the pump manufacturer.
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats. This may include painting exposed metals where hangers were removed or where equipment was moved or removed.
6. Paint shall withstand the following temperatures without peeling or discoloration:
   a. Condensate and Feedwater: 38 degrees C (100 degrees F) on insulation jacket surface and 121 degrees C (250 degrees F) on metal pipe surface.
   b. Steam: 52 degrees C (125 degrees F) on insulation jacket surface and 190 degrees C (374 degrees F) on metal pipe surface.
7. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.
8. Lead based paints are prohibited.

3.7 IDENTIFICATION SIGNS

A. Provide laminated plastic signs, with engraved lettering not less than 5 mm (3/16 inch) high, designating functions, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance.

C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

D. Attach ceiling grid label on ceiling grid location directly underneath above-ceiling air terminal, control system component, valve, filter unit, fan etc.

3.8 MOTOR AND DRIVES

A. Use synchronous belt drives only on equipment controlled by soft starters or variable frequency drive motor controllers without a bypass contactor. Use V-belt drives on all other applications.

B. Alignment of V-Belt Drives: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.

C. Alignment of Synchronous Belt Drives: Set driving and driven shafts parallel and align so that the corresponding pulley flanges are in the same plane.

D. Alignment of Direct-Connect Drives: Securely mount motor in accurate alignment so that shafts are per coupling manufacturer’s tolerances when both motor and driven machine are operating at normal temperatures.

3.9 LUBRICATION

A. All equipment and devices requiring lubrication shall be lubricated prior to initial operation. Field-check all devices for proper lubrication.

B. All devices and equipment shall be equipped with required lubrication fittings or devices. A minimum of 1 liter (1 quart) of oil and 1/2 kg (1 pound) of grease of manufacturer's recommended grade and type for each different application shall be provided; also provide 12 grease sticks for lubricated plug valves. Deliver all materials to COR in unopened containers that are properly identified as to application.

C. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

D. All lubrication points shall be extended to one side of the equipment.

3.10 STARTUP, TEMPORARY OPERATION AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. Startup of equipment shall be performed as described in equipment specifications. Vibration within specified tolerance shall be verified prior to extended operation. Temporary use of equipment is specified

in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.11 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS Article, TESTS, and in individual Division 23 specification sections and submit the test reports and records to the COR.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost or time to the Government.

C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then conduct such performance tests and finalize control settings for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work. Rescheduling of these tests shall be requested in writing to COR for approval.

D. No adjustments may be made during the acceptance inspection. All adjustments shall have been made by this point.

3.12 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

- - - E N D - - -

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:
   1. Planning systematic TAB procedures.
   2. Design Review Report.
   3. Systems Inspection report.
   4. Duct Air Leakage test report.
   5. Systems Readiness Report.
   6. Balancing air and water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
   7. Vibration and sound measurements.
   8. Recording and reporting results.
   9. Document critical paths of flow on reports.

B. Definitions:
   1. Basic TAB used in this Section: Chapter 39, "Testing, Adjusting and Balancing" of 2019 ASHRAE Handbook, "HVAC Applications".
   2. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
   3. AABC: Associated Air Balance Council.
   4. NEBB: National Environmental Balancing Bureau.
   5. TABB: Testing Adjusting and Balancing Bureau
   6. SMACNA: Sheet Metal Contractors National Association
   7. Hydronic Systems: Includes heating hot water.
   8. Air Systems: Includes all outside air, supply air, return air, exhaust air and relief air systems.
   9. Flow rate tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
D. Section 23 07 11, HVAC AND BOILER PLANT INSULATION.

E. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

F. Section 23 31 00, HVAC DUCTS AND CASINGS.

G. Section 23 36 00, AIR TERMINAL UNITS.

1.3 APPLICABLE PUBLICATIONS

A. The following publications form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):

2019.....ASHRAE Handbook - HVAC Applications, Chapter 39, Testing, Adjusting, and Balancing and Chapter 49, Noise and Vibration Control

C. Associated Air Balance Council (AABC):

2016.....National Standards for Total System Balance, 7th Edition

D. National Environmental Balancing Bureau (NEBB):

2019.....Procedural Standard for Testing, Adjusting, and Balancing of Environmental Systems, 9th Edition

2015.....Procedural Standard for the Measurement of Sound and Vibration, 2nd Edition

S110-2019.....Whole Building Technical Commissioning of New Construction, 2nd Edition

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

2002.....HVAC Systems Testing, Adjusting and Balancing, 3rd Edition.

2003.....TAB Procedural Guide 1st Edition

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC", with applicable paragraph identification.

C. Submit names and qualifications of TAB agency and TAB Specialists within 60 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.

D. For use by the COR staff, submit one complete set of applicable AABC, NEBB or TABB publications that will be the basis of TAB work.

E. Submit the following for review and approval:

1. Design Review Report within 90 days for conventional design projects after the system layout on air and water side is completed by the Contractor.
2. Systems inspection report on equipment and installation for conformance with design.
3. Duct Air Leakage Test Report.
4. Systems Readiness Report.
5. Intermediate and Final TAB reports covering flow balance and adjustments, performance tests, vibration tests and sound tests.
6. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.
7. Include in each report the critical path for each balanced branch (air and hydronic). Every branch shall have at least one terminal device damper 100 percent open.

F. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area with noted critical paths.

1.5 QUALITY ASSURANCE

A. Refer to paragraphs QUALITY ASSURANCE and SUBMITTALS, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Qualifications:

1. TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.
2. The TAB agency shall be either a certified member of AABC, NEBB, or TABB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the COR and

submit another qualified TAB firm for approval. Any agency that has been the subject of disciplinary action by either the AABC, TABB or NEBB within the five (5) years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work performed by the predecessor agency.

3. TAB Specialist: The TAB Specialist shall be either a member of AABC or TABB or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the COR and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five (5) years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB Specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and shall be performed by an approved successor.
4. TAB Specialist shall be identified by the General Contractor within sixty (60) days after the Notice to Proceed. The TAB Specialist will be coordinating, scheduling, and reporting all TAB work and related activities and will provide necessary information as required by the COR. The responsibilities shall specifically include:
   a. Directly supervising all TAB work.
   b. Sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC, TABB or NEBB.
   c. Following all TAB work through its satisfactory completion.
   d. Providing final markings of settings of all HVAC adjustment devices.
   e. Permanently mark location of duct test ports.

f. Documenting critical paths from the fan or pump. These critical paths are ones in which are 100 percent open from the fan or pump to the terminal device. This will show the least amount of restriction is being imposed on the system by the TAB firm.

5. All TAB technicians performing actual TAB work shall be experienced and shall have done satisfactory work on a minimum of three (3) projects comparable in size and complexity to this project. Qualifications shall be certified by the TAB agency in writing. The lead technician shall be certified by AABC, TABB or NEBB.

C. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards, TABB/SMACNA International Standards, or by NEBB Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose. All equipment shall remain in calibration, or be re-calibrated if certification expires, during the TAB procedures.

D. TAB Criteria:

1. One or more of the applicable AABC, NEBB, TABB or SMACNA publications, supplemented by Chapter 39, "Testing, Adjusting and Balancing" of ASHRAE Handbook "HVAC Applications" and requirements stated herein shall be the basis for planning, procedures, and reports.

2. Flow Rate Tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow Chapter 39, "Testing, Adjusting and Balancing" of ASHRAE Handbook "HVAC Applications" as a guideline. Air Filter resistance during tests, artificially imposed, if necessary, shall be at least 100 percent of manufacturer recommended change over pressure drop values for pre-filters and after-filters.

a. Air handling unit and all other fans, cubic meters/min (cubic feet per minute): Minus 5 percent to plus 10 percent.

b. Air Terminal Units (maximum values): Minus 5 percent to plus 10 percent

c. Exhaust Hoods/Cabinets: 0 percent to plus 10 percent.

d. Minimum Outside Air: 0 percent to plus 10 percent.

e. Individual room air outlets and inlets, and air flow rates not mentioned above: Minus 5 percent to plus 10 percent except if the air-to-air space is 100 CFM or less the tolerance will be minus 5 to plus 5 percent.
f. Heating Hot Water Pumps and Hot Water Coils: Minus 5 percent to plus 5 percent.
g. Chilled Water and Condenser Water Pumps: Minus 5 percent to plus 5 percent.
h. Chilled Water Coils: Minus 5 percent to plus 5 percent.

3. Systems shall be adjusted for energy efficient operation as described in PART 3.
4. Typical TAB procedures and critical path results shall be demonstrated to the COR for one air distribution system (including all fans, 3 terminal units, 3 rooms randomly selected by the COR, one of which shall be a critical path) and 1 hydronic system (pumps and 3 coils) as follows:
   a. When field TAB work begins.
   b. During each partial final inspection and the final inspection for the project if requested by VA.

PART 2 - PRODUCTS

2.1 PLUGS

A. Provide plastic plugs to seal holes drilled in ductwork for test purposes.

2.2 INSULATION REPAIR MATERIAL

A. See Section 23 07 11, HVAC and BOILER PLANT INSULATION Provide for repair of insulation removed or damaged for TAB work.

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to TAB Criteria in Article, Quality Assurance.
B. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.

3.2 DESIGN REVIEW REPORT

A. The TAB Specialist shall review the Contract Plans and specifications and advise the COR of any design deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence

of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

3.3 SYSTEMS INSPECTION REPORT

A. Inspect equipment and installation for conformance with design.

B. The inspection and report is to be done after air distribution equipment is on site and duct installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.

C. Reports: Follow check list format developed by AABC, NEBB or SMACNA (TABB), supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. Check air terminal unit installation including their duct sizes and routing.

3.4 DUCT AIR LEAKAGE TEST REPORT

A. TAB Agency shall perform the leakage test as outlined in "Duct leakage Tests and Repairs" in Section 23 31 00, HVAC DUCTS and CASINGS for TAB agency’s role and responsibilities in witnessing, recording and reporting of deficiencies.

3.5 SYSTEM READINESS REPORT

A. The TAB Contractor shall measure existing air and water flow rates associated with existing systems utilized to serve renovated areas as indicated on drawings. Submit report of findings to COR.

B. Inspect each System to ensure that it is complete including installation and operation of controls. Submit report to RE in standard format and forms prepared and or approved by the Commissioning Agent.

C. Verify that all items such as ductwork piping, dampers, valves, ports, terminals, connectors, etc. that is required for TAB are installed. Provide a report to the COR.

3.6 TAB REPORTS

A. Submit an intermediate report for 50 percent of systems and equipment tested and balanced to establish satisfactory test results.

B. The TAB contractor shall provide raw data immediately in writing to the COR if there is a problem in achieving intended results before submitting a formal report.

C. If over 20 percent of readings in the intermediate report fall outside the acceptable range, the TAB report shall be considered invalid and all contract TAB work shall be repeated after engineering and construction have been evaluated and re-submitted for approval at no additional cost to the owner.

D. Do not proceed with the remaining systems until intermediate report is approved by the COR.

3.7 TAB PROCEDURES

A. TAB shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC, TABB or NEBB. Balancing shall be done proportionally to all applicable systems.
   1. At least 1 trunk damper shall be 100 percent open.
   2. At least 1 branch damper shall be 100 percent open per trunk.
   3. At least 1 terminal device duct be 100 percent open per branch.
   4. At least one hydronic balancing valve shall be 100 percent open per hydronic system.

B. General: During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.

C. Coordinate TAB procedures with existing systems and any phased construction completion requirements for the project. Provide TAB reports for pre-construction air and water flow rate and for each phase of the project prior to partial final inspections of each phase of the project. Return existing areas outside the work area to pre-constructed conditions.

D. Allow 21 days' time in construction schedule for TAB and submission of all reports for an organized and timely correction of deficiencies.

E. Air Balance and Equipment Test: Include air-handling units, fans, terminal units, fan coil units, room diffusers/outlets/inlets, computer room AC units, and laboratory fume hoods and biological safety cabinets.

1. Artificially load air filters by partial blanking to produce static air pressure drop of manufacturer’s recommended pressure drop.
2. Adjust fan speeds to provide design air flow. V-belt drives, including fixed pitch pulley requirements, are specified in Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide new drive sets as required to adjust fan speeds.
3. Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other HVAC controls function properly.
4. Variable Air Volume (VAV) Systems:
   a. Coordinate TAB, including system volumetric controls, with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
   b. Section 23 36 00, AIR TERMINAL UNITS, specifies that maximum and minimum flow rates for air terminal units (ATU) be factory set. Check and readjust ATU flow rates if necessary to meet design criteria. Balance air distribution from ATU on full cooling maximum scheduled cubic meters per minute (cubic feet per minute). Reset room thermostats and check ATU operation from maximum to minimum cooling, to the heating mode, and back to cooling. Record and report the heating coil leaving air temperature when the ATU is in the maximum heating mode. Record and report outdoor air flow rates under all operating conditions (The test shall demonstrate that the minimum outdoor air ventilation rate shall remain constant under all operating conditions).
   c. Adjust operating pressure control setpoint to maintain the design flow to each space with the lowest setpoint. Confirm static pressure reset is operational and functioning properly.
5. Record final measurements for air handling equipment performance data sheets.
6. Record final damper settings for all manual volume dampers.

3.8 MARKING OF SETTINGS

A. Following approval of Tab final Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the COR.

3.9 IDENTIFICATION OF TEST PORTS

A. The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

3.10 CRITICAL FLOW PATH

A. Provide a documented critical path for all fluid flows. There shall be at least one terminal device that can be traced back to the fan or pump where there is no damper or valves that are less than 100% open.

- - E N D - - -

SECTION 23 07 11
HVAC AND BOILER PLANT INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Field applied insulation for thermal efficiency and condensation control for:HVAC piping, ductwork, and equipment.

B. Definitions

1. Air-conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
2. ASJ: All service jacket, white finish facing or jacket.
3. Cold: Equipment, ductwork or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
4. Concealed: Ductwork and piping above ceilings and in chases, and pipe spaces.
5. Density: kg/m^3 - kilograms per cubic meter (Pcf - pounds per cubic foot).
6. Exposed: Piping, ductwork, and equipment exposed to view in finished areas including mechanical, and electrical equipment rooms or exposed to outdoor weather. Attics and crawl spaces where air handling units are located are mechanical rooms. Shafts, chases, unfinished attics, crawl spaces, and pipe basements are not considered finished areas.
7. FSK: Foil-scrim-kraft facing.
8. Hot: HVAC Ductwork handling air at design temperature above 16 degrees C (60 degrees F); HVAC equipment or piping handling media above 41 degrees C (105 degrees F).
9. Runouts: Branch pipe connections up to 25-mm (one-inch) nominal size to fan coil units or reheat coils for terminal units.
10. Thermal conductance: Heat flow rate through materials.
    a. Flat surface: Watt per square meter (BTU per hour per square foot).
    b. Pipe or Cylinder: Watt per square meter (BTU per hour per linear foot).
11. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).

12. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders shall have a maximum published permeance of 0.1 perms and vapor barriers shall have a maximum published permeance of 0.001 perms.
13. HWH: Hot water heating supply.
14. HWHR: Hot water heating return.
15. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

1.2 RELATED WORK

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Section 07 84 00, FIRESTOPPING.

C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.3 QUALITY ASSURANCE

A. Refer to article QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Criteria:

1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.10.2.6, and 5.4.6.4, parts of which are quoted as follows:

4.3.3.1 Pipe insulation and coverings, duct coverings, duct linings, vapor retarder facings, adhesives, fasteners, tapes, and supplementary materials added to air ducts, plenums, panels, and duct silencers used in duct systems, unless otherwise provided for in 4.3.3.1.1 or 4.3.3.1.2., shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*.

4.3.3.1.1 Where these products are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state. *(See 4.2.4.2.)*

4.3.3.1.2 The flame spread and smoke developed index requirements of 4.3.3.1.1 shall not apply to air duct weatherproof coverings where they are located entirely outside of a building, do not penetrate a wall or roof, and do not create an exposure hazard.

4.3.3.2 Closure systems for use with rigid and flexible air ducts tested in accordance with UL 181, Standard for Safety Factory-Made Air Ducts and Air Connectors, shall have been tested, listed, and used in accordance with the conditions of their listings, in accordance with one of the following:

(1) UL 181A, Standard for Safety Closure Systems for Use with Rigid Air Ducts and Air Connectors

(2) UL 181B, Standard for Safety Closure Systems for Use with Flexible Air Ducts and Air Connectors

4.3.3.3 Air duct, panel, and plenum coverings and linings, and pipe insulation and coverings shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C 411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service.

4.3.3.3.1 In no case shall the test temperature be below 121°C (250°F).

4.3.3.4 Air duct coverings shall not extend through walls or floors that are required to be fire stopped or required to have a fire resistance rating, unless such coverings meet the requirements of 5.4.6.4.

4.3.3.5* Air duct linings shall be interrupted at fire dampers to prevent interference with the operation of devices.

4.3.3.6 Air duct coverings shall not be installed to conceal or prevent the use of any service opening.

4.3.10.2.6 Materials exposed to the airflow shall be noncombustible or limited combustible and have a maximum smoke developed index of 50 or comply with the following.

4.3.10.2.6.1 Electrical wires and cables and optical fiber cables shall be listed as noncombustible or limited combustible and have a maximum smoke developed index of 50 or shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

4.3.10.2.6.4 Optical-fiber and communication raceways shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 2024, Standard for Safety Optical-Fiber Cable Raceway.

4.3.10.2.6.6 Supplementary materials for air distribution systems shall be permitted when complying with the provisions of 4.3.3.

5.4.6.4 Where air ducts pass through walls, floors, or partitions that are required to have a fire resistance rating and where fire dampers are not required, the opening in the construction around the air duct shall be as follows:

(1) Not exceeding a 25 mm (1 in.) average clearance on all sides

(2) Filled solid with an approved material capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to the time-temperature fire conditions required for fire barrier penetration as specified

in NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*

2. Test methods: ASTM E84, UL 723, or NFPA 255.
3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
4. All materials shall be compatible and suitable for service temperature and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.4 SUBMITTALS

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

B. Shop Drawings:

1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.
   a. Insulation materials: Specify each type used and state surface burning characteristics.
   b. Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed ductwork, casings and equipment.
   c. Insulation accessory materials: Each type used.
   d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
   e. Refer to applicable specification paragraph numbers for coordination.

C. Samples:

1. Each type of insulation: Minimum size 100 mm (4 inches) square for board/block/ blanket; 150 mm (6 inches) long, full diameter for round types.
2. Each type of facing and jacket: Minimum size 10 cm (4 inches) square.
3. Each accessory material: Minimum 120 ML (4 ounce) liquid container or 120 gram (4 ounce) dry weight for adhesives / cement / mastic.

1.5 STORAGE AND HANDLING OF MATERIAL

A. Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

1.6 APPLICABLE PUBLICATIONS

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

B. Federal Specifications (Fed. Spec.):

L-P-535E-1979 (Notice4 2012) Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid

C. Military Specifications (Mil. Spec.):

MIL-A-3316D-2020 .....Adhesives, Fire-Resistant, Thermal Insulation

MIL-A-24179A-1969(R2020) Adhesive, Flexible Unicellular-Plastic Thermal Insulation

MIL-C-19565C-1980(AMD1 1988) Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier

MIL-C-20079H-1987.....Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass

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

B209-2014.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C411-2019.....Standard test method for Hot-Surface Performance of High-Temperature Thermal Insulation

C449-2007(R2019).....Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

C533-2023.....Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

C534/C534M-2023.....Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C547-2022.....Standard Specification for Mineral Fiber pipe Insulation

C552-2022 .....Standard Specification for Cellular Glass Thermal Insulation

C553-2013(R2019) .....Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

C585-2022.....Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing

C612-2014(R2019).....Standard Specification for Mineral Fiber Block and Board Thermal Insulation

C1126- 2019.....Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation

C1136-2023.....Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

D1668/D1668M-97a(2021e1) Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing

E84-2023.....Standard Test Method for Surface Burning Characteristics of Building Materials

E119-2022 Standard Test Method for Fire Tests of Building Construction and Materials

E136-2022Standard Test Methods for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C (1380 F)

E. National Fire Protection Association (NFPA):

90A-2024 .....Standard for the Installation of Air Conditioning and Ventilating Systems

101-2021 .....Life Safety Code

F. Underwriters Laboratories, Inc (UL):

723-2021 .....UL Standard for Safety Test for Surface Burning Characteristics of Building Materials, 11th Edition

G. Manufacturer's Standardization Society of the Valve and Fitting Industry (MSS):

SP58-2018(AMD1 2019) ...Pipe Hangers and Supports Materials, Design, and Manufacture

PART 2 - PRODUCTS

2.1 MINERAL FIBER OR FIBER GLASS

A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m^3 (3 pcf), k = 0.037 (0.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F) with foil scrim (FSK) facing.

B. ASTM C553 (Blanket, Flexible) Type I, Class B-3, Density 16 kg/m^3 (1 pcf), k = 0.045 (0.31) at 24 degrees C (75 degrees F), for use at temperatures up to 204 degrees C (400 degrees F) with foil scrim (FSK) facing.

C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.037 (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (450 degrees F) with an all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.

2.2 MINERAL WOOL OR REFRACTORY FIBER

A. Comply with Standard ASTM C612, Class 3, 450 degrees C (850 degrees F).

2.3 INSULATION FACINGS AND JACKETS

A. Vapor Retarder, higher strength with low water permeance of 0.02 or less perm rating, Beach puncture 50 units for insulation facing on exposed ductwork, casings and equipment, and for pipe insulation jackets. Facings and jackets shall be all service type (ASJ) or PVDC Vapor Retarder jacketing.

B. ASJ jacket shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 50 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75 mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.

C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: Foil-Scrim-Kraft (FSK) or PVDC vapor retarder jacketing type for concealed ductwork and equipment.

D. Field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping and ductwork as well as on interior piping and ductwork exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.) in high humidity areas, conveying fluids below ambient temperature. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.

E. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2000 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weatherproof if utilized for outside service.

F. Factory composite materials may be used if they have been tested and certified by the manufacturer.

2.4 MECHANICAL FASTENERS

A. Pins, anchors: Welded pins or metal or nylon anchors with galvanized steel-coated or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.

B. Staples: Outward clinching monel or galvanized steel.

C. Wire: 1.3 mm thick (18 gauge) soft annealed galvanized or 1.9 mm (14 gauge) copper clad steel or nickel copper alloy.

D. Bands: 13 mm (0.5 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

2.5 REINFORCEMENT AND FINISHES

A. Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).

B. Glass fiber fitting tape: Mil. Spec MIL-C-20079, Type II, Class 1.

C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.

D. Hexagonal wire netting: 25 mm (1 inch) mesh, 0.85 mm thick (22 gauge) galvanized steel.

E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gauge) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gauge) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.

F. PVC fitting cover: Fed. Spec L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Below 4 degrees C (40 degrees F) and above 121 degrees C (250 degrees F). Provide double layer insert. Provide color matching vapor barrier pressure sensitive tape.

2.6 FIRESTOPPING MATERIAL

A. Other than pipe and duct insulation, refer to Section 07 84 00 FIRESTOPPING.

2.7 FLAME AND SMOKE

A. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Required pressure tests of duct and piping joints and connections shall be completed and the work approved by the COR for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.

B. Except for specific exceptions, insulate entire specified equipment, piping (pipe, fittings, valves, accessories), and duct systems. Insulate each pipe and duct individually. Do not use scrap pieces of insulation where a full-length section will fit.

C. Insulation materials shall be installed in a first-class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor retarder over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 15 cm (6 inches).

D. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.

E. Construct insulation on parts of equipment such as chilled water pumps and heads of chillers, convertors and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gauge) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.

F. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.

G. Protect all insulation outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.

H. HVAC work not to be insulated:

1. Internally insulated ductwork and air handling units.
2. Relief air ducts (Economizer cycle exhaust air).
3. Exhaust air ducts and plenums, and ventilation exhaust air shafts.

I. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.

J. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. Fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary

size and shape to fit on the fitting. Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.

K. Firestop Pipe and Duct insulation:
   1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed as defines in Section 07 84 00, FIRESTOPPING.
   2. Duct penetrations requiring fire stop insulation including, but not limited to the following:
      a. Duct chase walls and floors
      b. Smoke partitions
      c. Fire partitions

L. Provide vapor barrier jackets over insulation as follows:
   1. All piping and ductwork exposed to outdoor weather.

3.2 INSULATION INSTALLATION

A. Mineral Fiber Board:
   1. Faced board: Apply board on pins spaced not more than 30 cm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.
   2. Plain board:
      a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 22 cm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.
   3. Exposed, unlined ductwork and equipment in unfinished areas, mechanical and electrical equipment rooms and attics, and duct work exposed to outdoor weather:
      a. 40 mm (1-1/2 inch) thick insulation faced with ASJ (white all service jacket): Supply air duct and after filter housing.
      b. 40 mm (1-1/2 inch) thick insulation faced with ASJ: Return air duct, mixed air plenums and prefilter housing.
      c. Outside air intake ducts: 25 mm (one inch) thick insulation faced with ASJ.

B. Flexible Mineral Fiber Blanket:

1. Adhere insulation to metal with 75 mm (3 inch) wide strips of insulation bonding adhesive at 20 cm (8 inches) on center all around duct. Additionally, secure insulation to bottom of ducts exceeding 60 cm (24 inches) in width with pins welded or adhered on 45 cm (18 inch) centers. Secure washers on pins. Butt insulation edges and seal joints with laps and butt strips. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations with mastic. Sagging duct insulation will not be acceptable. Install firestop duct insulation where required.
2. Supply air ductwork to be insulated includes main and branch ducts from AHU discharge to room supply outlets, and the bodies of ceiling outlets to prevent condensation. Insulate sound attenuator units, coil casings and damper frames. To prevent condensation, insulate trapeze type supports and angle iron hangers for flat oval ducts that are in direct contact with metal duct.
3. Concealed supply air ductwork.
   a. Above ceilings at a roof level, in attics, and duct work exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with FSK.
   b. Above ceilings for other than roof level: 40 mm (1-1/2 inch) thick insulation faced with FSK.
4. Concealed return air duct:
   a. Above ceilings at a roof level, unconditioned areas, and in chases with external wall or containing steam piping; 40 mm (1-1/2 inch) thick, insulation faced with FSK.
   b. Concealed return air ductwork in other locations need not be insulated.

- - - E N D - - -

SECTION 23 09 23
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. General Contractor shall provide direct-digital control system(s) to tie into the existing system(s) as indicated on the project documents, point list, interoperability tables, drawings and as described in these specifications. Include a complete and working direct-digital control system. Include all engineering, programming, configuration/setup hardware and software, controls and installation materials, installation labor, verification and startup, training, final project documentation and warranty. A System Integrator and Direct Digital Controls Contractor shall be two separate direct subcontractors of General Contractor.

1. The direct-digital control system(s) shall consist of high-speed, peer-to-peer network of DDC controllers, a control system server, all configuration and setup software and hardware devices, and an Engineering Control Center. Provide a remote user using a standard HTML 5 web browser to access the control system graphics and change adjustable setpoints with the proper password.
2. All new building controllers shall be native BACnet. All new BACnet workstations, controllers, devices, and components shall be listed by BACnet Testing Laboratories. All new BACnet workstations, controllers, devices, and components shall be accessible using a HTML5 Web browser interface. Browsers shall not require the use of an extension or add on software in order to access aforementioned workstations, controllers, devices, and components.
   a. If used, gateways shall be BTL listed.
   b. If used, gateways shall provide all object properties and read/write services shown on VA-approved interoperability schedules.
3. The work administered by this Section of the technical specifications shall include all labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, Project specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, submittals, testing, verification,

training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, Warranty, specified services and any other items required for a complete and fully functional Controls System.

4. The control systems shall be designed such that each mechanical system shall operate under stand-alone mode. The A/E shall designate what each "mechanical systems" is composed of. The contractor administered by this Section of the technical specifications shall provide controllers for each mechanical system. In the event of a network communication failure, or the loss of any other controller, the control system shall continue to operate independently. Failure of the ECC shall have no effect on the field controllers, including those involved with global strategies.

B. Some products are furnished but not installed by the contractor administered by this Section of the technical specifications. The contractor administered by this Section of the technical specifications shall formally coordinate in writing and receive from other contractors formal acknowledgements in writing prior to submission the installation of the products. These products include but are not limited to the following:
   1. Control valves.
   2. Flow switches.
   3. Flow meters.
   4. Sensor wells and sockets in piping.
   5. Terminal unit controllers.

C. Some products are installed but not furnished by the contractor administered by this Section of the technical specifications. The contractor administered by this Section of the technical specifications shall formally coordinate in writing and receive from other contractors formal acknowledgements in writing prior to submission the procurement of the products. These products include but are not limited to the following:
   1. Factory-furnished accessory thermostats and sensors furnished with unitary equipment.

D. Some products are not provided by, but are nevertheless integrated with the work executed by, the contractor administered by this Section of

the technical specifications. These products include but are not limited to the following:

1. Fire alarm systems. If zoned fire alarm is required by the project-specific requirements, this interface shall require multiple relays, which are provided and installed by the fire alarm system contractor, to be monitored.
2. Terminal units' velocity sensors.

E. Responsibility Table:

Work/Item/System	Furnish	Install	Low Voltage Wiring	Line Power
Control system low voltage and communication wiring	23 09 23	23 09 23	23 09 23	N/A
Terminal units	Div. 23	Div. 23	N/A	Div. 26
Controllers for terminal units	23 09 23	Div. 23	23 09 23	Div. 26
LAN conduits and raceway	23 09 23	23 09 23	N/A	N/A
Automatic dampers (not furnished with equipment)	23 09 23	Div. 23	23 09 23	N/A
Automatic damper actuators	23 09 23	23 09 23	23 09 23	23 09 23
Manual valves	Div. 23	Div. 23	N/A	N/A
Automatic valves	23 09 23	Div. 23	23 09 23	23 09 23
Pipe insertion devices and taps, flow and pressure stations.	Div. 23	Div. 23	N/A	N/A
Thermowells	23 09 23	Div. 23	N/A	N/A
Current Switches	23 09 23	23 09 23	23 09 23	N/A
Control Relays	23 09 23	23 09 23	23 09 23	N/A
All control system nodes, equipment, housings, enclosures and panels.	23 09 23	23 09 23	23 09 23	Div. 26

for licenses residing in the B-BC's or B-AAC's.

F. This facility's existing direct-digital control (DDC) system is manufactured by Siemens, and its ECC is located at the Chiller Plant. The existing system's top-end communications is via BACnet. The contractor administered by this Section of the technical specifications shall observe the capabilities, communication network, services, spare

capacity of the existing control system and its ECC prior to beginning work.

1. Leave existing direct-digital control system intact and in place. Connect into the existing system with BACnet-compliant control system serving the work in this project. Full interoperability is required.

G. This campus has standardized on an existing standard ASHRAE Standard 135, BACnet/IP Control System supported by a preselected controls service company. This entity is referred to as the "Control System Integrator" in this Section of the technical specifications. The Control system integrator is responsible for ECC system graphics and expansion. It also prescribes control system-specific verification procedures to the contractor administered by this Section of the technical specification. It lastly provides limited assistance to the contractor administered by this Section of the technical specification in its verification work.

1. The General Contractor of this project shall directly hire the Control System Integrator in a contract separate from the contract procuring the controls contractor administered by this Section of the technical specifications.
2. The contractor administered by this Section of the technical specifications shall coordinate all work with the Control System Integrator. The contractor administered by this Section of the technical specifications shall integrate the ASHRAE Standard 135, BACnet/IP control network(s) with the Control System Integrator's B-AWS through an Ethernet connection provided by either the Control System Integrator or VA.
3. The contractor administered by this Section of the technical specifications shall provide a peer-to-peer networked, stand-alone, distributed control system. This direct digital control (DDC) system at least shall include one portable operator terminal - laptop, one digital display unit, microprocessor-based controllers, instrumentation, end control devices, wiring, piping, software, and related systems. This contractor is responsible for all device mounting and wiring.

4. Responsibility Table:

Item/Task	Section 23 09 23 contactor	Control system integrator	VA
ECC expansion		X	
ECC programming		X	
Devices, controllers, control panels and equipment	X		
Point addressing: all hardware and software points including setpoint, calculated point, data point(analog/ binary), and reset schedule point	X		
Point mapping		X	
Network Programming	X		
ECC Graphics		X	
Controller programming and sequences	X		
Integrity of LAN communications			X
Electrical wiring	X		
Operator system training		X	
LAN connections to devices			X
LAN connections to ECC			X
IP addresses			X
Controller and system verification	X		

H. The direct-digital control system shall start and stop equipment, move (position) damper actuators and valve actuators, and vary speed of equipment to execute the mission of the control system. Use electricity as the motive force for all damper and valve actuators, unless use of pneumatics as motive force is specifically granted in writing by the VA.

1.2 RELATED WORK

A. Section 01 81 13, Sustainable Construction Requirements.

B. Section 23 31 00, HVAC Ducts and Casings.

C. Section 23 36 00, Air Terminal Units.

D. Section 26 05 11, Requirements for Electrical Installations.

E. Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables (600 Volts and Below).

F. Section 26 05 26, Grounding and Bonding for Electrical Systems.

G. Section 26 05 33, Raceway and Boxes for Electrical Systems.

H. Section 27 15 00, Communications Horizontal Cabling.

I. Section 28 31 00, Fire Detection and Alarm.

1.3 DEFINITION

A. Algorithm: A logical procedure for solving a recurrent mathematical problem; A prescribed set of well-defined rules or processes for the solution of a problem in a finite number of steps.

B. Analog: A continuously varying signal value (e.g., temperature, current, velocity etc.

C. BACnet: A Data Communication Protocol for Building Automation and Control Networks -as defined by ANSI/ASHRAE Standard 135. This communications protocol allows diverse building automation devices to communicate data and services over a network.

D. BACnet/IP: Annex J of Standard 135. It defines and allows for using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP sub-networks that share the same BACnet network number.

E. BACnet Internetwork: Two or more BACnet networks connected with routers. The two networks may use different LAN technologies.

F. BACnet Network: One or more BACnet segments that have the same network address and are interconnected by bridges at the physical and data link layers.

G. BACnet Segment: One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.

H. BACnet Broadcast Management Device (BBMD): A communications device which broadcasts BACnet messages to all BACnet/IP devices and other BBMDs connected to the same BACnet/IP network.

I. BACnet Interoperability Building Blocks (BIBBs): BACnet Interoperability Building Blocks (BIBBs) are collections of one or more BACnet services. These are prescribed in terms of an “A” and a “B” device. Both of these devices are nodes on a BACnet internetwork.

J. BACnet Testing Laboratories (BTL). The organization responsible for testing products for compliance with the BACnet standard, operated under the direction of BACnet International.

K. Baud: It is a signal change in a communication link. One signal change can represent one or more bits of information depending on type of transmission scheme. Simple peripheral communication is normally one

bit per Baud. (e.g., Baud rate = 78,000 Baud/sec is 78,000 bits/sec, if one signal change = 1 bit).

L. Binary: A two-state system where a high signal level represents an "ON" condition and an "OFF" condition is represented by a low signal level.

M. BMP or bmp: Suffix, computerized image file, used after the period in a DOS-based computer file to show that the file is an image stored as a series of pixels.

N. Bus Topology: A network topology that physically interconnects workstations and network devices in parallel on a network segment.

O. Control Unit (CU): Generic term for any controlling unit, stand-alone, microprocessor based, digital controller residing on secondary LAN or Primary LAN, used for local controls or global controls.

P. Deadband: A temperature range over which no heating or cooling is supplied, i.e., 22-25 degrees C (72-78 degrees F), as opposed to a single point change over or overlap).

Q. Device: a control system component that contains a BACnet Device Object and uses BACnet to communicate with other devices.

R. Device Object: Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object Identifier number on the BACnet internetwork. This number is often referred to as the device instance.

S. Device Profile: A specific group of services describing BACnet capabilities of a device, as defined in ASHRAE Standard 135, Annex L. Standard device profiles include BACnet Operator Workstations (B-OWS), BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC), BACnet Application Specific Controllers (B-ASC), BACnet Smart Actuator (B-SA), and BACnet Smart Sensor (B-SS). Each device used in new construction is required to have a PICS statement listing which service and BIBBs are supported by the device.

T. Diagnostic Program: A software test program, which is used to detect and report system or peripheral malfunctions and failures. Generally, this system is performed at the initial startup of the system.

U. Direct Digital Control (DDC): Microprocessor based control including Analog/Digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and processed by a microprocessor, and digital control signals are

generated based on control algorithms and transmitted to field devices in order to achieve a set of predefined conditions.

V. Distributed Control System: A system in which the processing of system data is decentralized and control decisions can and are made at the subsystem level. System operational programs and information are provided to the remote subsystems and status is reported back to the Engineering Control Center. Upon the loss of communication with the Engineering Control center, the subsystems shall be capable of operating in a stand-alone mode using the last best available data.

W. Download: The electronic transfer of programs and data files from a central computer or operation workstation with secondary memory devices to remote computers in a network (distributed) system.

X. DXF: An AutoCAD 2-D graphics file format. Many CAD systems import and export the DXF format for graphics interchange.

Y. Electrical Control: A control circuit that operates on line or low voltage and uses a mechanical means, such as a temperature sensitive bimetal or bellows, to perform control functions, such as actuating a switch or positioning a potentiometer.

Z. Electronic Control: A control circuit that operates on low voltage and uses a solid-state components to amplify input signals and perform control functions, such as operating a relay or providing an output signal to position an actuator.

AA. Engineering Control Center (ECC): The centralized control point for the intelligent control network. The ECC comprises of personal computer and connected devices to form a single workstation.

BB. Ethernet: A trademark for a system for exchanging messages between computers on a local area network using coaxial, fiber optic, or twisted-pair cables.

CC. Firmware: Firmware is software programmed into read only memory (ROM) chips. Software may not be changed without physically altering the chip.

DD. Gateway: Communication hardware connecting two or more different protocols. It translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a gateway has BACnet on one side and non-BACnet (usually proprietary) protocols on the other side.

EE. GIF: Abbreviation of Graphic interchange format.

FF. Graphic Program (GP): Program used to produce images of air handler systems, fans, chillers, pumps, and building spaces. These images can be animated and/or color-coded to indicate operation of the equipment.

GG. Graphic Sequence of Operation: It is a graphical representation of the sequence of operation, showing all inputs and output logical blocks.

HH. I/O Unit: The section of a digital control system through which information is received and transmitted. I/O refers to analog input (AI, digital input (DI), analog output (AO) and digital output (DO). Analog signals are continuous and represent temperature, pressure, flow rate etc., whereas digital signals convert electronic signals to digital pulses (values), represent motor status, filter status, on-off equipment etc.

II. I/P: a method for conveying and routing packets of information over LAN paths. User Datagram Protocol (UDP) conveys information to “sockets” without confirmation of receipt. Transmission Control Protocol (TCP) establishes "sessions", which have end-to-end confirmation and guaranteed sequence of delivery.

JJ. JPEG: A standardized image compression mechanism stands for Joint Photographic Experts Group, the original name of the committee that wrote the standard.

KK. Local Area Network (LAN): A communication bus that interconnects operator workstation and digital controllers for peer-to-peer communications, sharing resources and exchanging information.

LL. Network Repeater: A device that receives data packets from one network and rebroadcasts to another network. No routing information is added to the protocol.

MM. MS/TP: Master-slave/token-passing (ISO/IEC 8802-3:2021). It uses twisted-pair wiring for relatively low speed and low-cost communication.

NN. Native BACnet Device: A device that uses BACnet as its primary method of communication with other BACnet devices without intermediary gateways. A system that uses native BACnet devices at all levels is a native BACnet system.

OO. Network Number: A site-specific number assigned to each network segment to identify for routing. This network number must be unique throughout the BACnet internetwork.

PP. Object: The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.

QQ. Object Identifier: An object property used to identify the object, including object type and instance. Object Identifiers must be unique within a device.

RR. Object Properties: Attributes of an object. Examples include present value and high limit properties of an analog input object. Properties are defined in ASHRAE 135; some are optional and some are required. Objects are controlled by reading from and writing to object properties.

SS. Operating system (OS): Software, which controls the execution of computer application programs.

TT. PCX: File type for an image file. When photographs are scanned onto a personal computer they can be saved as PCX files and viewed or changed by a special application program as Photo Shop.

UU. Peripheral: Different components that make the control system function as one unit. Peripherals include monitor, printer, and I/O unit.

VV. Peer-to-Peer: A networking architecture that treats all network stations as equal partners- any device can initiate and respond to communication with other devices.

WW. PICS: Protocol Implementation Conformance Statement, describing the BACnet capabilities of a device. All BACnet devices have published PICS.

XX. PID: Proportional, integral, and derivative control, used to control modulating equipment to maintain a setpoint.

YY. Repeater: A network component that connects two or more physical segments at the physical layer.

ZZ. Router: a component that joins together two or more networks using different LAN technologies. Examples include joining a BACnet Ethernet LAN to a BACnet MS/TP LAN.

AAA. Sensors: devices measuring state points or flows, which are then transmitted back to the DDC system.

BBB. Thermostats : devices measuring temperatures, which are used in control of standalone or unitary systems and equipment not attached to the DDC system.

1.4 QUALITY ASSURANCE

A. Criteria:

1. Single Source Responsibility of subcontractor: Either the DDC Contractor or the System Integrator shall obtain hardware and software supplied under this Section and delegate the responsibility to a single source controls installation subcontractor. The Integration subcontractor shall be responsible for the complete design, installation, integration, and verification of the system. The controls subcontractor shall be in the business of design, installation, and service of such building automation control systems similar in size and complexity.
2. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in production and installation of HVAC control systems. Products shall be manufacturer’s latest standard design and have been tested and proven in actual use.
3. The controls subcontractor shall provide a list of no less than five similar projects which have building control systems as specified in this Section. These projects must be on-line and functional such that the Department of Veterans Affairs (VA) representative could observe the control systems in full operation.
4. The controls subcontractor shall have an in-place facility within 50 miles with technical staff, spare parts inventory for the next five (5) years, and necessary test and diagnostic equipment to support the control systems.
5. The controls subcontractor shall have minimum of three years of experience in design and installation of building automation systems similar in performance to those specified in this Section. Provide evidence of experience by submitting resumes of the project manager, the local branch manager, project engineer, the application engineering staff, and the electronic technicians who would be involved with the supervision, the engineering, and the installation of the control systems. Training and experience of these personnel shall not be less than three years. Failure to disclose this information will be a ground for disqualification of the supplier.
6. Provide a competent and experienced Project Manager employed by the Controls Contractor. The Project Manager shall be supported as

necessary by other Contractor employees in order to provide professional engineering, technical and management service for the work. The Project Manager shall attend scheduled Project Meetings as required and shall be empowered to make technical, scheduling, and related decisions on behalf of the Controls Contractor.

B. Codes and Standards:
   1. All work shall conform to the applicable Codes and Standards.
   2. Electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference, and be so labeled.

1.5 PERFORMANCE

A. The system shall conform to the following:
   1. Graphic Display: The system shall display up to four (4) graphics on a single screen with a minimum of twenty (20) dynamic points per graphic. All current data shall be displayed within ten (10) seconds of the request.
   2. Graphic Refresh: The system shall update all dynamic points with current data within eight (8) seconds. Data refresh shall be automatic, without operator intervention.
   3. Object Command: The maximum time between the command of a binary object by the operator and the reaction by the device shall be two(2) seconds. Analog objects shall start to adjust within two (2) seconds.
   4. Object Scan: All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or work-station will be current, within the prior six (6) seconds.
   5. Alarm Response Time: The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed (10) seconds.
   6. Program Execution Frequency: Custom and standard applications shall be capable of running as often as once every (5) seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
   7. Multiple Alarm Annunciations: All workstations on the network shall receive alarms within five (5) seconds of each other.

8. Performance: Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every one (1) second. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
9. Reporting Accuracy: Listed below are minimum acceptable reporting end-to-end accuracies for all values reported by the specified system:

Measured Variable	Reported Accuracy
Space temperature	±0.5 degrees C (±1 degrees F)
Ducted air temperature	±0.5 degrees C [±1 degrees F]
Outdoor air temperature	±1.0 degrees C [±2 degrees F]
Dew Point	±1.5 degrees C [±3 degrees F]
Air flow (terminal)	±10 percent of reading
Air flow (measuring stations)	±5 percent of reading
Air pressure (ducts)	±25 Pa [±0.1 inch wg]
Air pressure (space)	±0.3 Pa [±0.001 inch wg]
Electrical Power	±0.5 percent of reading

Note 1: for both absolute and differential pressure.

10. Control stability and accuracy: Control sequences shall maintain measured variable at setpoint within the following tolerances:

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±50 Pa (±0.2 inch wg)	0-1.5 kPa (0-6 inch wg)
Air Pressure	±3 Pa (±0.01 inch wg)	-25 to 25 Pa (-0.1 to 0.1 inch wg)
Airflow	±10 percent of full scale	
Space Temperature	±1.0°C (±2.0 degrees F)	
Duct Temperature	±1.5°C (±3 degrees F)	

11. Extent of direct digital control: control design shall allow for at least the points indicated on the points lists on the drawings.

1.6 WARRANTY

A. Labor and materials for control systems shall be warranted for a period as specified under Warranty in FAR clause 52.246-21.

B. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no cost or reduction in service to the owner.

The system includes all computer equipment, transmission equipment, and all sensors and control devices.

C. The on-line support service shall allow the Controls supplier to dial out over telephone lines to or connect via (through password-limited access) VPN through the internet to monitor and control the facility's building automation system. This remote connection to the facility shall be within two (2) hours of the time that the problem is reported. This coverage shall include normal business hours, after business hours, weekend, and holidays. If the problem cannot be resolved with on-line support services, the Controls supplier shall dispatch the qualified personnel to the job site to resolve the problem within 24 hours after the problem is reported.

D. Controls subcontractor shall be responsible for temporary operations and maintenance of the control systems during the construction period until final verification, training of facility operators and acceptance of the project by VA.

1.7 SUBMITTALS

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

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC", with applicable paragraph identification.

C. Manufacturer's Literature and Data Including:

1. A wiring diagram for each type of input device and output device including DDC controllers, modems, repeaters, etc. Diagram shall show how the device is wired and powered, showing typical connections at the digital controllers and each power supply, as well as the device itself. Show for all field connected devices, including but not limited to, control relays, motor starters, electric or electronic actuators, and temperature pressure, flow and humidity sensors and transmitters.
2. A diagram of each terminal strip, including digital controller terminal strips, terminal strip location, termination numbers and the associated point names.
3. Control dampers and control valves schedule, including the size and pressure drop.

4. Control air-supply components, and computations for sizing compressors, receivers, and main air-piping, if pneumatic controls are furnished.
5. Catalog cut sheets of all equipment used. This includes but is not limited to software (by manufacturer and by third parties), DDC controllers, panels, peripherals, airflow measuring stations and associated components, and auxiliary control devices such as sensors, actuators, and control dampers. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted. Each submitted piece of literature and drawings should clearly reference the specification and/or drawings that it supposed to represent.
6. Sequence of operations for each system and the associated control diagrams. Equipment and control labels shall correspond to those shown on the drawings.
7. Color prints of proposed graphics with a list of points for display.
8. Furnish a BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet-compliant device.
9. Schematic wiring diagrams for all control, communication, and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers and functions. Show all interface wiring to the control system.
10. An instrumentation list for each controlled system. Each element of the controlled system shall be listed in table format. The table shall show element name, type of device, manufacturer, model number, and product data sheet number.
11. Riser diagrams of wiring between central control unit (CCU) and all control panels.
12. Plan drawings showing routing of LAN and locations of control panels, controllers, routers, gateways, ECC, and larger controlled devices.
13. Construction details for all installed conduit, cabling, raceway, cabinets, and similar. Construction details of all penetrations and their protection.

14. Quantities of submitted items may be reviewed but it is the responsibility of the contractor administered by this Section of the technical specifications to provide sufficient quantities for a complete and working system.

D. Product Certificates: Compliance with Article, QUALITY ASSURANCE.

E. Validation Test Plan: Along with manufacturer's literature, product certificates, wiring and functional diagrams, and sequence of operations, submit for review and approval a Validation Test Plan which is specific to the work of this project and which references the specific controls component nomenclatures found in the control contractor's wiring and functional diagrams and the specific sequences of controls for this project and which describes how the contractor will implement the controls system validation and demonstration as specified in paragraph 3.2 SYSTEM VALIDATION AND DEMONSTRATION found in this section.

F. Licenses: Provide licenses for all software residing on and used by the Controls Systems, ECC, and portable OWS and transfer these licenses to the Owner prior to completion.

G. As Built Control Drawings:

1. Furnish three (3) copies of as-built drawings for each control system. The documents shall be submitted for approval prior to final completion.
2. Furnish one (1) set of applicable control system prints for each mechanical system for wall mounting. The documents shall be submitted for approval prior to final completion.
3. Furnish one (1) CD-ROM in CAD DWG and/or .DXF format for the drawings noted in subparagraphs above.

H. Operation and Maintenance (O/M) Manuals):

1. Submit in accordance with Article, INSTRUCTIONS, in Specification Section 01 00 00, GENERAL REQUIREMENTS.
2. Include the following documentation:
   a. General description and specifications for all components, including logging on/off, alarm handling, producing trend reports, overriding computer control, and changing set points and other variables.

b. Detailed illustrations of all the control systems specified for ease of maintenance and repair/replacement procedures, and complete calibration procedures.
c. One copy of the final version of all software provided including operating systems, programming language, operator workstation software, and graphics software.
d. Complete troubleshooting procedures and guidelines for all systems.
e. Complete operating instructions for all systems.
f. Recommended preventive maintenance procedures for all system components including a schedule of tasks for inspection, cleaning and calibration. Provide a list of recommended spare parts needed to minimize downtime.
g. Training Manuals: Submit the course outline and training material to the Owner for approval three (3) weeks prior to the training to VA facility personnel. These persons will be responsible for maintaining and the operation of the control systems, including programming. The Owner reserves the right to modify any or all of the course outline and training material.
h. Licenses, guaranty, and other pertaining documents for all equipment and systems.

I. Submit Performance Report to COR prior to final inspection.

1.8 INSTRUCTIONS

A. Instructions to VA operations personnel: Perform in accordance with Article, INSTRUCTIONS, in Specification Section 01 00 00, GENERAL REQUIREMENTS, and as noted below.
1. First Phase: Formal instructions to the VA facilities personnel for a total of 16 hours, given in multiple training sessions (each no longer than four hours in length), conducted sometime between the completed installation and prior to the performance test period of the control system, at a time mutually agreeable to the Contractor and the VA.
2. Second Phase: This phase of training shall comprise of on the job training during startup, checkout period, and performance test period. VA facilities personnel will work with the Contractor’s installation and test personnel on a daily basis during startup and checkout period. During the performance test period, controls

subcontractor will provide 8 hours of instructions, given in multiple training sessions (each no longer than four hours in length), to the VA facilities personnel.

3. The O/M Manuals shall contain approved submittals as outlined in Article 1.7, SUBMITTALS. The Controls subcontractor will review the manual contents with VA facilities personnel during second phase of training.
4. Training shall be given by direct employees of THE CONTROLS system subcontractor.

1.9 PROJECT CONDITIONS (ENVIRONMENTAL CONDITIONS OF OPERATION)

A. The ECC and peripheral devices and system support equipment shall be designed to operate in ambient condition of 20 to 35 degrees C (65 to 90 degrees F) at a relative humidity of 20 to 80 percent non-condensing.

B. The Controllers used outdoors shall be mounted in NEMA 4 waterproof enclosures, and shall be rated for operation at -40 to 65 degrees C (-40 to 150 degrees F).

C. All electronic equipment shall operate properly with power fluctuations of plus 10 percent to minus 15 percent of nominal supply voltage.

D. Sensors and controlling devices shall be designed to operate in the environment, which they are sensing or controlling.

1.10 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):

135-2020.....BACnet A Data Communication Protocol for Building Automation and Control Networks

147-2019.....Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems

C. Federal Communication Commission (FCC):

Rules and Regulations Title 47 Chapter 1-2014 Part 15: Radio Frequency Devices

D. Institute of Electrical and Electronic Engineers (IEEE):

802.3-2018.....Standard for Ethernet

E. National Fire Protection Association (NFPA):

70-2023.....National Electric Code

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use new products that the manufacturer is currently manufacturing and that have been installed in a minimum of 25 installations. Spare parts shall be available for at least five years after completion of this contract.

2.2 CONTROLS SYSTEM ARCHITECTURE

A. General

1. The Controls Systems shall consist of multiple Nodes and associated equipment connected by industry standard digital and communication network arrangements.
2. The ECC, building controllers and principal communications network equipment shall be standard products of recognized major manufacturers available through normal PC and computer vendor channels – not "Clones" assembled by a third-party subcontractor.
3. The networks shall, at minimum, comprise, as necessary, the following:
   a. A fixed ECC and a portable operator’s terminal.
   b. Network computer processing, data storage and BACnet-compliant communication equipment including Servers and digital data processors.
   c. BACnet-compliant routers, bridges, switches, hubs, modems, gateways, interfaces, and similar communication equipment.
   d. Active processing BACnet-compliant building controllers connected to other BACnet-compliant controllers together with their power supplies and associated equipment.
   e. Addressable elements, sensors, transducers, and end devices.
   f. Third-party equipment interfaces and gateways as described and required by the Contract Documents.
   g. Other components required for a complete and working Control Systems as specified.

B. The Specifications for the individual elements and component subsystems shall be minimum requirements and shall be augmented as necessary by

the Contractor to achieve both compliance with all applicable codes, standards, and to meet all requirements of the Contract Documents.

C. Network Architecture
   1. The Controls communication network shall utilize BACnet communications protocol operating over a standard Ethernet LAN and operate at a minimum speed of 100 Mb/sec.
   2. The networks shall utilize only copper and optical fiber communication media as appropriate and shall comply with applicable codes, ordinances, and regulations.
   3. All necessary telephone lines, ISDN lines and internet Service Provider services and connections will be provided by the VA.

D. Third Party Interfaces:
   1. The contractor administered by this Section of the technical specifications shall include necessary hardware, equipment, software and programming to allow data communications between the controls systems and building systems supplied by other trades.
   2. Other manufacturers and contractors supplying other associated systems and equipment shall provide their necessary hardware, software and startup at their cost and shall cooperate fully with the contractor administered by this Section of the technical specifications in a timely manner and at their cost to ensure complete functional integration.

E. Servers:
   1. Provide data storage server(s) to archive historical data including trends, alarm and event histories and transaction logs.
   2. Equip these server(s) with the same software tool set that is located in the BACnet building controllers for system configuration and custom logic definition and color graphic configuration.
   3. Access to all information on the data storage server(s) shall be through the same browser functionality used to access individual nodes. When logged onto a server the operator will be able to also interact with any other controller on the control system as required for the functional operation of the controls systems. The contractor administered by this Section of the technical specifications shall provide all necessary digital processor programmable data storage server(s).

4. These server(s) shall be utilized for controls systems application configuration, for archiving, reporting, and trending of data, for operator transaction archiving and reporting, for network information management, for alarm annunciation, for operator interface tasks, for controls application management and similar.

2.3 COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. controller, and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.

1. The Data link / physical layer protocol between the ECC and all B-BC's (for communication) acceptable to the VA throughout its facilities is Ethernet (ISO 8802-3) and BACnet/IP.

B. Each controller shall have a communication port for connection to an operator interface.

2.4 BACnet PROTOCOL ANALYZER

A. For ease of troubleshooting and maintenance, provide a BACnet protocol analyzer. Provide its associated fittings, cables, and appurtenances, for connection to the communications network. The BACnet protocol analyzer shall be able to, at a minimum: capture and store to a file all data traffic on all network levels; measure bandwidth usage; filter out (ignore) selected traffic.

2.5 NETWORK AND DEVICE NAMING CONVENTION

A. Network Numbers

1. BACnet network numbers shall be based on a "facility code, network" concept. The "facility code" is the VAMC's or VA campus' assigned numeric value assigned to a specific facility or building. The "network" typically corresponds to a "floor" or other logical configuration within the building. BACnet allows 65535 network numbers per BACnet internet work.
2. The network numbers are thus formed as follows: "Net #" = "FFFNN" where:
   a. FFF = Facility code (see below).
   b. NN = 00-99 This allows up to 100 networks per facility or building.

B. Device Instances

1. BACnet allows 4194305 unique device instances per BACnet internet work. Using Agency's unique device instances are formed as follows: "Dev #" = "FFFNNDD" where:
   a. FFF and N are as above.
   b. DD = 00-99, this allows up to 100 devices per network.
2. Note Special cases, where the network architecture of limiting device numbering to DD causes excessive subnet works. The device number can be expanded to DDD and the network number N can become a single digit. In NO case shall the network number N and the device number D exceed 4 digits.
3. Facility code assignments:
4. 000-400 Building/facility number.
5. Note that some facilities have a facility code with an alphabetic suffix to denote wings, related structures, etc. The suffix will be ignored. Network numbers for facility codes greater than 400 will be assigned in the range 000-399.

C. Device Names

1. Name the control devices based on facility name, location within a facility, the system, or systems that the device monitors and/or controls, or the area served. The intent of the device naming is to be easily recognized. Names can be up to 254 characters in length, without embedded spaces. Provide the shortest descriptive, but unambiguous, name. For example, in building #123 prefix the number with a “B” followed by the building number, if there is only one chilled water pump "CHWP-1", a valid name would be "B123.CHWP. 1.STARTSTOP". If there are two pumps designated "CHWP-1", one in a basement mechanical room (Room 0001) and one in a penthouse mechanical room (Room PH01), the names could be "B123.R0001.CHWP.1. STARTSTOP" or "B123.RPH01.CHWP.1.STARTSTOP". In the case of unitary controllers, for example a VAV box controller, a name might be "B123.R101.VAV". These names should be used for the value of the "Object_Name" property of the BACnet Device objects of the controllers involved so that the BACnet name and the EMCS name are the same.

2.6 BACnet DEVICES

A. All BACnet Devices – controllers, gateways, routers, actuators, Operator Displays, and sensors shall conform to BACnet Device Profiles

and shall be BACnet Testing Laboratories (BTL) -Listed as conforming to those Device Profiles. Protocol Implementation Conformance Statements (PICSs), describing the BACnet capabilities of the Devices shall be published and available for the Devices through links in the BTL website.

1. BACnet Building Controllers, shall conform to the BACnet B-BC Device Profile, and shall be BTL-Listed as conforming to the B-BC Device Profile. The Device's PICS shall be submitted.
2. BACnet Advanced Application Controllers shall conform to the BACnet B-AAC Device Profile and shall be BTL-Listed as conforming to the B-AAC Device Profile. The Device's PICS shall be submitted.
3. BACnet Application Specific Controllers shall conform to the BACnet B-ASC Device Profile and shall be BTL-Listed as conforming to the B-ASC Device Profile. The Device's PICS shall be submitted.
4. BACnet Smart Actuators shall conform to the BACnet B-SA Device Profile and shall be BTL-Listed as conforming to the B-SA Device Profile. The Device's PICS shall be submitted.
5. BACnet Smart Sensors shall conform to the BACnet B-SS Device Profile and shall be BTL-Listed as conforming to the B-SS Device Profile. The Device's PICS shall be submitted.
6. BACnet routers and gateways shall conform to the BACnet B-OTH Device Profile and shall be BTL-Listed as conforming to the B-OTH Device Profile. The Device's PICS shall be submitted.

2.7 CONTROLLERS

A. General. Provide an adequate number of BTL listed B-BC building controllers, BTL listed B-AAC, BTL listed B-ASC, BTL listed B-SA, and BTL listed B-SS's to achieve the performance specified in the Part 1 Article on "System Performance." Each of these controllers shall meet the following requirements.

1. Communication.
   a. Each B-BC controller shall reside on a BACnet network using the ISO 8802-3 (Ethernet) Data Link/Physical layer protocol for its communications.
   b. Each B-BC controller shall provide a service communication port using BACnet Data Link/Physical layer protocol for connection to a portable operator's terminal. If this port is not available

built into the controller, contractor is to install a 4 port unmanaged switch inside the B-BC control cabinet.

2. Keypad. A local keypad and display shall be provided for each controller. The keypad shall be provided for interrogating and editing data. Provide a system security password to prevent unauthorized use of the keypad and display.
3. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
4. Memory. The controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
5. The controller shall be able to operate at 90 percent to 110 percent of nominal voltage rating and shall perform an orderly shutdown less than 80 percent nominal voltage. Controller operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 watt at 1 meter (3 feet).
6. Transformer. Power supply for the ASC must be rated at a minimum of 125 percent of B-ASC power consumption and shall be of the fused or current limiting type.

B. Provide BTL-Listed B-ASC application specific controllers for each piece of equipment for which they are constructed. Application specific controllers shall communicate with other BACnet devices on the internetwork using the BACnet Read (Execute) Property service.

1. Each B-ASC shall be capable of stand-alone operation and shall continue to provide control functions without being connected to the network.
2. Each B-ASC will contain sufficient I/O capacity to control the target system.
3. Communication.
   a. Each controller shall reside on a BACnet network using the ISO 8802-3 (Ethernet) Data Link/Physical layer protocol for its communications. Each building controller also shall perform BACnet routing if connected to a network of custom application and application specific controllers.
   b. Each controller shall have a BACnet Data Link/Physical layer compatible connection for a laptop computer or a portable

operator's tool. This connection shall be extended to a space temperature sensor port where shown.

4. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
5. Memory. The application specific controller shall use nonvolatile memory and maintain all BIOS and programming information in the event of a power loss.
6. Immunity to power and noise. Controllers shall be able to operate at 90 percent to 110 percent of nominal voltage rating and shall perform an orderly shutdown below 80 percent. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 watts at 1 meter (3 feet).

C. Direct Digital Controller Software

1. The software programs specified in this section shall be commercially available, concurrent, multi-tasking operating system and support the use of software application that operates under Microsoft Windows.
2. All points shall be identified by up to 30-character point name and 16-character point descriptor. The same names shall be used at the ECC.
3. All control functions shall execute within the stand-alone control units. All new controllers installed will also include all software and/or hardware required to program, verify, or alter the sequence of operation of said controller(s). Controllers requiring software or hardware that is not commercially available will not be allowed. Installation of software and/or hardware for controller configuration will be the responsibility of the DDC contractor. COR will direct to install said hardware and/or software on either the B-AWS or portable operator terminal. The VA shall be able to customize control strategies and sequences of operations defining the appropriate control loop algorithms and choosing the optimum loop parameters without requiring the services of a DDC contractor.
4. All controllers shall be capable of being programmed to utilize stored default values for assured fail-safe operation of critical processes. Default values shall be invoked upon sensor failure or,

if the primary value is normally provided by the central or another CU, or by loss of bus communication. Individual application software packages shall be structured to assume a fail-safe condition upon loss of input sensors. Loss of an input sensor shall result in output of a sensor-failed message at the ECC. Each ACU and RCU shall have capability for local readouts of all functions. The UCUs shall be read remotely.

5. All DDC control loops shall be able to utilize any of the following control modes:
   a. Two position (on-off, slow-fast) control.
   b. Proportional control.
   c. Proportional plus integral (PI) control.
   d. Proportional plus integral plus derivative (PID) control. All PID programs shall automatically invoke integral wind up prevention routines whenever the controlled unit is off, under manual control of an automation system or time-initiated program.
   e. Automatic tuning of control loops.
6. System Security: Operator access shall be secured using individual password and operator’s name. Passwords shall restrict the operator to the level of object, applications, and system functions assigned to him. A minimum of three (3)or a maximum of six (6) levels of security for operator access shall be provided.
7. Application Software: The controllers shall provide the following programs as a minimum for the purpose of optimizing energy consumption while maintaining comfortable environment for occupants. All application software shall reside and run in the system digital controllers. Editing of the application shall occur at the ECC or via a portable operator’s terminal, when it is necessary, to access directly the programmable unit.
   a. Night Setback/Morning Warm up Control: The system shall provide the ability to automatically adjust set points for this mode of operation.
   b. Event Scheduling: Provide a comprehensive menu driven program to automatically start and stop designated points or a group of points according to a stored time. This program shall provide the capability to individually command a point or group of points. When points are assigned to one common load group it shall be

possible to assign variable time advances/delays between each successive start or stop within that group. Scheduling shall be calendar based and advance schedules may be defined up to one year in advance. Advance schedule shall override the day-to-day schedule. The operator shall be able to define the following information:

1) Time, day.
2) Commands such as on, off, auto.
3) Time delays between successive commands.
4) Manual overriding of each schedule.
5) Allow operator intervention.

c. Alarm Reporting: The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the ECC based on time and events. An alarm shall be able to start programs, log in the event, print and display the messages. The system shall allow the operator to prioritize the alarms to minimize nuisance reporting and to speed operator's response to critical alarms. A minimum of six (6) priority levels of alarms shall be provided for each point.

d. Remote Communications: The system shall have the ability to dial out in the event of an alarm to the ECC and alpha-numeric pagers. The alarm message shall include the name of the calling location, the device that generated the alarm, and the alarm message itself. The operator shall be able to remotely access and operate the system using dial up communications. Remote access shall allow the operator to function the same as local access.

e. Maintenance Management (PM): The program shall monitor equipment status and generate maintenance messages based upon the operators defined equipment run time, starts, and/or calendar date limits. A preventative maintenance alarm shall be printed indicating maintenance requirements based on pre-defined run time. Each preventive message shall include point description, limit criteria and preventative maintenance instruction assigned to that limit. A minimum of 480-character PM shall be provided for each component of units such as air handling units.

2.8 SENSORS (AIR, WATER AND STEAM)

A. Sensors' measurements shall be read back to the DDC system and shall be visible by the ECC.

B. Temperature and Humidity Sensors shall be electronic, vibration and corrosion resistant for wall, immersion, and/or duct mounting. Provide all remote sensors as required for the systems.

1. Temperature Sensors: thermistor type for terminal units and Resistance Temperature Device (RTD) with an integral 4-20 mA or 0-10 VDC transmitter type for all other sensors.

a. Duct sensors shall be rigid or averaging type as shown on drawings. Averaging sensor shall be a minimum of 30 cm (1 linear foot) of sensing element for each square feet of cooling/heating coil face area.

b. Immersion sensors shall be provided with a separable well made of stainless steel, bronze or monel material. Pressure rating of well is to be consistent with the system pressure in which it is to be installed. Temperature well shall be filled with a thermal compound compatible with installed sensor.

c. All space sensors shall be equipped with in-space User set-point adjustment, override switch, numerical temperature display on sensor cover, and BACnet communication port. Match room thermostats. Provide a tooled-access cover.

1) Public space sensor: setpoint adjustment shall be only through the ECC or through the DDC system's diagnostic device/laptop. Do not provide in-space User set-point adjustment. Provide an opaque keyed-entry cover if needed to restrict in-space User set-point adjustment.

d. Wire: Twisted, shielded-pair cable.

e. Output Signal: 4-20 mA or 0-10 VDC.

C. Static Pressure Sensors: Non-directional, temperature compensated.

1. 4-20 mA or 0-10 VDC output signal.

2. 0 to 1250 Pa (0 to 5 inches wg) for duct static pressure range.

3. 0 to 62.5 Pa (0 to 0.25 inch wg) for Building static pressure range.

2.9 CONTROL CABLES

A. General:

Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross

talk, and other impairments. Comply with Section 26 05 26, Grounding and Bonding for Electrical Systems and Section 27 05 26, Grounding and Bonding for Communications Systems.

1. Cable conductors to provide protection against induction in circuits. Crosstalk attenuation within the System shall be in excess of -80 dB throughout the frequency ranges specified.
2. Minimize the radiation of RF noise generated by the System equipment so as not to interfere with any audio, video, data, computer main distribution frame (MDF), telephone customer service unit (CSU), and electronic private branch exchange (EPBX) equipment the System may service.
3. The as-installed drawings shall identify each cable as labeled, used cable, and bad cable pairs.
4. Label system’s cables on each end. Test and certify cables in writing to the VA before conducting proof-of-performance testing. Minimum cable test requirements are for impedance compliance, inductance, capacitance, signal level compliance, opens, shorts, cross talk, noise, and distortion, and split pairs on all cables in the frequency ranges used. Make available all cable installation and test records at demonstration to the VA. All changes (used pair, failed pair, etc.) shall be posted in these records as the change occurs.
5. Power wiring shall not be run in conduit with communications trunk wiring or signal or control wiring operating at 100 volts or less.

B. Analogue control cabling shall be not less than 1 square mm (No. 18 AWG solid or stranded, with thermoplastic insulated conductors as specified in Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables.

C. Copper digital communication cable between the ECC and the B-BC and B-AAC controllers shall be 100BASE-TX Ethernet, Category 5e or 6, not less than minimum 0.25 square mm (24 American Wire Gauge (AWG)) solid, Shielded Twisted Pair (STP) or Unshielded Twisted Pair (UTP), with thermoplastic insulated conductors, enclosed in a thermoplastic outer jacket, as specified in Section 27 15 00, Communications Structured Cabling.

1. Other types of media commonly used within IEEE Std 802.3 LANs (e.g., 10Base-T and 10Base-2) shall be used only in cases to interconnect with existing media.

D. All MS/TP communications cables for devices utilizing the EIA-485 standard must be listed for use on EIA-485 networks by the manufacturer of the cable. This requirement overrides any cable recommendation by the controller manufacturer. The use of EIA-485 communication cables shall not affect the warranty from the installing DDC contractor. Cables shall have the following characteristic:
   1. Nominal Impedance: 100-130 Ohms
   2. Twisted/shielded construction of 1, 1.5, or 2 pairs depending on controller requirements.
   3. Be plenum rated when required
   4. Cables designated for use by the cable manufacturer for use in PA or Speaker systems shall not be allowed, regardless of recommendations by the controller manufacturer.

E. Optical digital communication fiber, if used, shall be Multimode or Single mode fiber, 62.5/125 micron for multimode or 10/125 micron for single mode micron with SC or ST connectors as specified in TIA-568-C.1. Terminations, patch panels, and other hardware shall be compatible with the specified fiber and shall be as specified in Section 27 15 00. Fiber-optic cable shall be suitable for use with the 100Base-FX or the 100Base-SX standard (as applicable) as defined in IEEE Std 802.3.

2.10 THERMOSTATS AND HUMIDISTATS

A. Room thermostats controlling unitary standalone heating and cooling devices not connected to the DDC system shall have three modes of operation (heating - null or dead band - cooling). Thermostats for patient bedrooms shall have capability of being adjusted to eliminate null or dead band. Wall mounted thermostats shall have manufacturer's recommendation finish, setpoint range and temperature display and external adjustment:
   1. Electronic Thermostats: Solid-state, microprocessor based, BACnet enabled programmable to daily, weekend, and holiday schedules.
      a. Public Space Thermostat: Public space thermostat shall have a thermistor sensor and shall not have a visible means of set point adjustment. Adjustment shall be via the digital controller to which it is connected.

b. Battery replacement without program loss.

2.11 FINAL CONTROL ELEMENTS AND OPERATORS

A. Fail Safe Operation: Control valves and dampers shall provide "fail safe" operation in either the normally open or normally closed position as required for freeze, moisture, and smoke or fire protection.

B. Spring Ranges: Range as required for system sequencing and to provide tight shut-off.

C. Damper and Valve Operators and Relays:

1. Electric operator shall provide full modulating control of dampers and valves. For dampers a linkage and pushrod shall be furnished for mounting the actuator on the damper frame internally in the duct, externally in the duct, externally on the duct wall, or shall be furnished with a direct-coupled design. Metal parts shall be aluminum, mill finish galvanized steel, or zinc plated steel or stainless steel. Provide actuator heads which allow for electrical conduit attachment. The motor(s) shall have sufficient closure torque to allow for complete closure of valve or damper under pressure. Provide multiple motors as required to achieve sufficient close-off torque.

   a. Minimum valve close-off pressure shall be equal to the system pump’s dead-head pressure, minimum 345 kPa (50 psig) for valves smaller than 100 mm (4 inches).

2. Electronic damper operators: Metal parts shall be aluminum, mill finish galvanized steel, or zinc plated steel or stainless steel. Provide actuator heads which allow for electrical conduit attachment. The motors shall have sufficient closure torque to allow for complete closure of valve or damper under pressure. Provide multiple motors as required to achieve sufficient close-off torque.

   a. VAV Box actuator shall be mounted on the damper axle or shall be of the air valve design, and shall provide complete modulating control of the damper. The motor shall have a closure torque of 4 Newton-Meters (35-inch pounds) minimum with full torque applied at close off to attain minimum leakage.

3. See and coordinate drawings for required control operation.

2.12 AIR FLOW CONTROL

A. Airflow and static pressure shall be controlled via digital controllers with inputs from airflow control measuring stations and static pressure

inputs as specified. Controller outputs shall be analog or pulse width modulating output signals. The controllers shall include the capability to control via simple proportional (P) control, proportional plus integral (PI), proportional plus integral plus derivative (PID), and on-off. The airflow control programs shall be factory-tested programs that are documented in the literature of the control manufacturer.

B. Air Flow Measuring Station -- Electronic Thermal Type:

1. Air Flow Sensor Probe:

a. Each air flow sensor shall contain two individual thermal sensing elements. One element shall determine the velocity of the air stream while the other element shall compensate for changes in temperature. Each thermal flow sensor and its associated control circuit and signal conditioning circuit shall be factory calibrated and be interchangeable to allow replacement of a sensor without recalibration of the entire flow station. The sensor in the array shall be located at the center of equal area segment of the duct and the number of sensors shall be adequate to accommodate the expected velocity profile and variation in flow and temperature. The airflow station shall be of the insertion type in which sensor support structures are inserted from the outside of the ducts to make up the complete electronic velocity array.

b. Thermal flow sensor shall be constructed of hermetically sealed thermistors or nickel chromium or reference grade platinum wire, wound over an epoxy, stainless steel or ceramic mandrel and coated with a material suitable for the conditions to be encountered. Each dual sensor shall be mounted in an extruded aluminum alloy strut.

2. Air Flow Sensor Grid Array:

a. Each sensor grid shall consist of a lattice network of temperature sensors and linear integral controllers (ICs) situated inside an aluminum casing suitable for mounting in a duct. Each sensor shall be mounted within a strut facing downstream of the airflow and located so that it is protected on the upstream side. All wiring shall be encased (out of the air stream) to protect against mechanical damage.

b. The casing shall be made of welded aluminum of sufficient strength to prevent structural bending and bowing. Steel or iron composite shall not be acceptable in the casing material.

c. Pressure drop through the flow station shall not exceed 4 Pascal (0.015 inch WG) at 1,000 meter per minute (3,000 FPM).

3. Electronics Panel:

a. Electronics Panel shall consist of a surface mounted enclosure complete with solid-state microprocessor and software.

b. Electronics Panel shall be A/C powered 120 VAC and shall have the capability to transmit signals of 4-20 ma or 0-10 VDC type or PWM type for use in control of the HVAC Systems. The electronic panel shall have the capability to accept user defined scaling parameters for all output signals.

c. Electronics Panel shall have the capability to digitally display airflow in CFM and temperature in degrees F. The displays shall be provided as an integral part of the electronics panel. The electronic panel shall have the capability to totalize the output flow in CFM for two or more systems, as required. A single output signal shall be provided which will equal the sum of the systems totalized. Output signals shall be provided for temperature and airflow. Provide remote mounted air flow or temperature displays where indicated on the plans.

d. Electronics Panel shall have the following:

1) Minimum of 12-bit A/D conversion.

2) Field adjustable digital primary output offset and gain.

3) Airflow analog output scaling of 0.508 to 50.8 (100 to 10,000 FPM).

4) Temperature analog output scaling from -45 degrees C to 70 degrees C (-50 degrees F to 160 degrees F).

5) Analog output resolution (full scale output) of 0.025 percent.

e. All readings shall be in I.P. units.

4. Thermal flow sensors and its electronics shall be installed as per manufacturer’s instructions. The required probe sensor density shall be as follows:

Probe Sensor Density

Area (square meters)	Area (square feet)	Qty. Sensors
<=0.01	<=1	2

>0.01 to <0.37	>1 to <4	4
0.37 to <0.74	4 to <8	6
0.74 to <1.1	8 to <12	8
1.1 to <1.5	12 to <16	12
>=1.5	>=16	16

a. Complete installation shall not exhibit more than ± 2.0 percent error in airflow measurement output for variations in the angle of flow of up to 10 percent in any direction from its calibrated orientation. Repeatability of readings shall be within ± 0.25 percent.

C. Constant Volume Control Systems shall consist of an air flow measuring station along with such relays and auxiliary devices as required to produce a complete functional system. The transmitter shall receive its air flow signal or static pressure signal from the flow measuring station and shall have a span not exceeding three times the design flow rate. The CU shall receive the transmitter signal and shall provide an output to the fan volume control device to maintain a constant flow rate. The CU shall provide proportional plus integral (PI) (automatic reset) control mode and where required also inverse derivative mode. Overall system accuracy shall be plus or minus the equivalent of 2 Pascal (0.008 inch) velocity pressure as measured by the flow station.

D. Airflow Synchronization:

1. Systems shall consist of an air flow measuring station for each main supply and return duct, the CU and such relays, as required to provide a complete functional system that will maintain a constant flow rate difference between supply and return air to an accuracy of ±10 percent. In systems where there is no suitable location for a flow measuring station that will sense total supply or return flow, provide multiple flow stations with a differential pressure transmitter for each station. Signals from the multiple transmitters shall be added through the CU such that the resultant signal is a true representation of total flow.
2. The total flow signals from supply and return air shall be the input signals to the CU. This CU shall track the return air fan capacity in proportion to the supply air flow under all conditions.

2.13 SAFETY

A. Provide hard-wired interlocked connections for all safety devices such as freeze stats, smoke detectors, smoke dampers, and refrigerant leak detection devices. All safety devises shall be provided with additional dry contacts and shall be connected to the DDC system for monitoring and sequencing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Examine project plans for control devices and equipment locations; and report any discrepancies, conflicts, or omissions to COR for resolution before proceeding for installation.
2. Install equipment, piping, wiring /conduit parallel to or at right angles to building lines.
3. Install all equipment and piping in readily accessible locations. Do not run tubing and conduit concealed under insulation or inside ducts.
4. Mount control devices, tubing and conduit located on ducts and apparatus with external insulation on standoff support to avoid interference with insulation.
5. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
6. Run tubing and wire connecting devices on or in control cabinets parallel with the sides of the cabinet neatly racked to permit tracing.
7. Install equipment level and plumb.

B. Electrical Wiring Installation:

1. All wiring and cabling shall be installed in conduits. Install conduits and wiring in accordance with Specification Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Conduits carrying control wiring and cabling shall be dedicated to the control wiring and cabling: these conduits shall not carry power wiring. Provide plastic end sleeves at all conduit terminations to protect wiring from burrs.
2. Install analog signal and communication cables in conduit and in accordance with Specification Division 27 – COMMUNICATIONS. Install

digital communication cables in conduit and in accordance with Section 27 15 00, COMMUNICATIONS STRUCTURED CABLING.

3. Install conduit and wiring between operator workstation(s), digital controllers, electrical panels, indicating devices, instrumentation, miscellaneous alarm points, thermostats, and relays as shown on the drawings or as required under this section.
4. Install all electrical work required for a fully functional system and not shown on electrical plans or required by electrical specifications. Where low voltage (less than 50 volt) power is required, provide suitable Class B transformers.
5. Install all system components in accordance with local Building Code and National Electric Code.
   a. Splices: Splices in shielded and coaxial cables shall consist of terminations and the use of shielded cable couplers. Terminations shall be in accessible locations. Cables shall be harnessed with cable ties.
   b. Equipment: Fit all equipment contained in cabinets or panels with service loops, each loop being at least 30 cm (12 inches) long. Equipment for fiber optics system shall be rack mounted, as applicable, in ventilated, self-supporting, code gauge steel enclosure. Cables shall be supported for minimum sag.
   c. Cable Runs: Keep cable runs as short as possible. Allow extra length for connecting to the terminal board. Do not bend flexible coaxial cables in a radius less than ten times the cable outside diameter.
   d. Use vinyl tape, sleeves, or grommets to protect cables from vibration at points where they pass around sharp corners, through walls, panel cabinets, etc.
6. Conceal cables, except in mechanical rooms and areas where other conduits and piping are exposed.
7. Permanently label or code each point of all field terminal strips to show the instrument or item served. Color-coded cable with cable diagrams may be used to accomplish cable identification.
8. Grounding: ground electrical systems per manufacturer’s written requirements for proper and safe operation.

C. Install Sensors and Controls:
   1. Temperature Sensors:

a. Install all sensors and instrumentation according to manufacturer's written instructions. Temperature sensor locations shall be readily accessible, permitting quick replacement and servicing of them without special skills and tools.
b. Calibrate sensors to accuracy specified, if not factory calibrated.
c. Use of sensors shall be limited to its duty, e.g., duct sensor shall not be used in lieu of room sensor.
d. Install room sensors permanently supported on wall frame. They shall be mounted at 1.5 meter (5 feet) above the finished floor unless otherwise noted on the plans or drawings.
e. Mount sensors rigidly and adequately for the environment within which the sensor operates. Separate extended-bulb sensors form contact with metal casings and coils using insulated standoffs.
f. Sensors used in mixing plenum and hot and/or cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.
g. All pipe mounted temperature sensors shall be installed in wells.
h. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor reading.
i. Permanently mark terminal blocks for identification. Protect all circuits to avoid interruption of service due to short-circuiting or other conditions. Line-protect all wiring that comes from external sources to the site from lightning and static electricity.

2. Pressure Sensors:
   a. Install duct static pressure sensor tips facing directly downstream of airflow.
   b. Install high-pressure side of the differential switch between the pump discharge and the check valve.
   c. Install snubbers and isolation valves on steam pressure sensing devices.
3. Actuators:
   a. Mount and link damper and valve actuators according to manufacturer's written instructions.

b. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed position.

c. Check operation of valve/actuator combination to confirm that actuator modulates valve smoothly in both open and closed position.

D. Installation of network:

1. Ethernet:

a. The network shall employ Ethernet LAN architecture, as defined by IEEE 802.3. The Network Interface shall be fully Internet Protocol (IP) compliant allowing connection to currently installed IEEE 802.3, Compliant Ethernet Networks.

b. The network shall directly support connectivity to a variety of cabling types. As a minimum provide the following connectivity: 100 Base TX (Category 5e cabling) for the communications between the ECC and the B-BC and the B-AAC controllers.

2. Third party interfaces: Contractor shall integrate real-time data from building systems by other trades and databases originating from other manufacturers as specified and required to make the system work as one system.

E. Installation of digital controllers and programming:

1. Provide a separate digital control panel for each major piece of equipment, such as air handling unit, chiller, pumping unit etc. Points used for control loop reset such as outdoor air, outdoor humidity, or space temperature can be located on any of the remote control units.

2. Provide sufficient internal memory for the specified control sequences and trend logging. There shall be a minimum of 25 percent of available memory free for future use.

3. System point names shall be human readable, permitting easy operator interface without the use of a written point index.

4. Provide software programming for the applications intended for the systems specified, and adhere to the strategy algorithms provided.

5. Provide graphics for each piece of equipment and floor plan in the building. This includes each chiller, cooling tower, air handling unit, fan, terminal unit, boiler, pumping unit etc. These graphics shall show all points dynamically as specified in the point list.

3.2 SYSTEM VALIDATION AND DEMONSTRATION

A. As part of final system acceptance, a system demonstration is required (see below). Prior to start of this demonstration, the contractor is to perform a complete validation of all aspects of the controls and instrumentation system.

B. Validation

1. Prepare and submit for approval a validation test plan including test procedures for the performance verification tests. Test Plan shall be submitted for review with the control system submittal as indicated in paragraph 1.7 Submittals. Test Plan address all specified functions of the ECC and all specified sequences of operation. Explain in detail actions and expected results used to demonstrate compliance with the requirements of this specification. Explain the method for simulating the necessary conditions of operation used to demonstrate performance of the system. Test plan shall include a test check list to be used by the Installer’s agent to check and initial that each test has been successfully completed. Deliver test plan documentation for the performance verification tests to the owner’s representative 30 days prior to start of performance verification tests. Provide draft copy of operation and maintenance manual with performance verification test.
2. After approval of the validation test plan, installer shall carry out all tests and procedures therein. Installer shall completely check out, calibrate, and test all connected hardware and software to ensure that system performs in accordance with approved specifications and sequences of operation submitted. Installer shall complete and submit Test Check List.

C. Demonstration

1. System operation and calibration to be demonstrated by the installer in the presence of the Architect, CxA or COR on random samples of equipment as dictated by the COR. Should random sampling indicate improper work, the owner reserves the right to subsequently witness complete calibration of the system at no addition cost to the VA.
2. Make accessible, personnel to provide necessary adjustments and corrections to systems as directed by balancing agency.
3. The following witnessed demonstrations of field control equipment shall be included:

a. Observe HVAC systems in shut down condition. Check dampers and valves for normal position.
b. Test application software for its ability to communicate with digital controllers, operator workstation, and uploading and downloading of control programs.
c. Demonstrate the software ability to edit the control program off-line.
d. Demonstrate reporting of alarm conditions for each alarm and ensure that these alarms are received at the assigned location, including operator workstations.
e. Demonstrate ability of software program to function for the intended applications-trend reports, change in status etc.
f. Demonstrate via graphed trends to show the sequence of operation is executed in correct manner, and that the HVAC systems operate properly through the complete sequence of operation, e.g., seasonal change, occupied/unoccupied mode, and warm-up condition.
g. Demonstrate hardware interlocks and safeties functions, and that the control systems perform the correct sequence of operation after power loss and resumption of power loss.
h. Prepare and deliver to the VA graphed trends of all control loops to demonstrate that each control loop is stable and the set points are maintained.
i. Demonstrate that each control loop responds to set point adjustment and stabilizes within one (1) minute(s). Control loop trend data shall be instantaneous and the time between data points shall not be greater than one (1) minute.

4. Witnessed demonstration of ECC functions shall consist of:
   a. Running each specified report.
   b. Display and demonstrate each data entry to show site specific customizing capability. Demonstrate parameter changes.
   c. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
   d. Execute digital and analog commands in graphic mode.
   e. Demonstrate DDC loop precision and stability via trend logs of inputs and outputs (6 loops minimum).
   f. Demonstrate Energy Management System (EMS) performance via trend logs and command trace.

g. Demonstrate scan, update, and alarm responsiveness.
h. Demonstrate spreadsheet/curve plot software, and its integration with database.
i. Demonstrate on-line user guide, and help function and mail facility.
j. Demonstrate digital system configuration graphics with interactive upline and downline load, and demonstrate specified diagnostics.
k. Demonstrate multitasking by showing dynamic curve plot, and graphic construction operating simultaneously via split screen.
l. Demonstrate class programming with point options of beep duration, beep rate, alarm archiving, and color banding.

3.3 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in the operation and maintenance of the system.

3.5 CONSTRUCTION WASTE MANAGEMENT

A. General: Comply with Contractor’s Waste Management Plan and Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
B. To the greatest extent possible, separate reusable and recyclable products from contaminated waste and debris in accordance with the Contractor’s Waste Management Plan. Place recyclable and reusable products in designated containers and protect from moisture and contamination.

----- END -----

---INTENTIONALLY BLANK---

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Ductwork and accessories for HVAC including the following:

1. Supply air, return air, outside air, exhaust, make-up air, and relief systems.

C. Definitions:

1. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.
2. Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
3. Exposed Duct: Exposed to view in a finished room.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 07 84 00, FIRESTOPPING.

D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

E. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

F. Section 23 07 11, HVAC and BOILER PLANT INSULATION.

G. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

H. Section 23 36 00, AIR TERMINAL UNITS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.Where conflicts occur these specifications and the VHA standards will govern.

B. American Society of Civil Engineers (ASCE):

1. 7-2016.....Minimum Design Loads for Associated Criteria for Buildings and Other Structures

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

1. A653/A653M-2020.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

2. A1011/A1011-2018a....Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High Strength Low-Alloy with Improved Formability, and Ultra-High Strength
3. B209-2021.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
4. C1071-2019.....Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
5. E1-2014(R2020).....Standard Specification for ASTM Liquid-in-Glass Thermometers
6. E77-2014(R2021).....Standard Test Method for Inspection and Verification of Thermometers
7. E84-2021a.....Standard Test Method for Surface Burning Characteristics of Building Materials

D. National Fire Protection Association (NFPA):
1. 90A-2021.....Standard for the Installation of Air-Conditioning and Ventilating Systems
2. 96-2021.....Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
1. 006-2020.....HVAC Duct Construction Standards, Metal and Flexible, 4th Edition
2. 016-2012.....HVAC Air Duct Leakage Test Manual, 2nd Edition
3. 2016.....Fibrous Glass Duct Construction Standards, 7th Edition

F. Underwriters Laboratories, Inc. (UL):
1. 181-2013(R2017).....Standard for Factory-Made Air Ducts and Air Connectors
2. 555-2006(R2020) .....Standard for Fire Dampers
3. 555S-2014(R2020).....Standard for Smoke Dampers

G. Department of Veterans Affairs (VA):
1. PG-18-10-2015.....Physical Security Design Manual for VA Mission Critical Facilities

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 10 00, HVAC DUCTS AND CASINGS", with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Rectangular Ducts:
   a. Schedules of duct systems, materials and selected SMACNA construction alternatives for joints, sealing, gauge and reinforcement.
   b. Sealants and gaskets.
   c. Access doors.
2. Round Ducts:
   a. Manufacturer's details for duct fittings.
   b. Sealants and gaskets.
   c. Access sections.
   d. Installation instructions.
3. Volume dampers, back draft dampers.
4. Upper hanger attachments.
5. Flexible ducts and clamps, with manufacturer's installation instructions.
6. Flexible connections.
7. Instrument test fittings.
8. Details and design analysis of alternate or optional duct systems.

D. Coordination Drawings: Refer to paragraph SUBMITTALS in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.

3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

B. Fire Safety Code: Comply with NFPA 90A.

C. Duct System Construction and Installation: Referenced SMACNA Standards are the minimum acceptable quality.

D. Duct Sealing, Air Leakage Criteria, and Air Leakage Tests: Ducts shall be sealed as per duct sealing requirements of SMACNA HVAC Air Duct Leakage Test Manual for duct pressure classes shown in the contract documents.

E. Duct accessories exposed to the air stream, such as dampers of all types (except smoke dampers) and access openings, shall be of the same material as he duct or provide at least the same level of corrosion resistance.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 DUCT MATERIALS AND SEALANTS

A. General: Except for systems specified otherwise, construct ducts, casings, and accessories of galvanized sheet steel, ASTM A653/A653M, coating G90; or, aluminum sheet, ASTM B209, alloy 1100, 3003 or 5052.

B. Specified Corrosion Resistant Systems: Stainless-steel sheet, Class 302 or 304, Condition A (annealed) Finish No. 4 for exposed ducts and Finish No. 2B for concealed duct or ducts located in mechanical rooms.

C. Joint Sealing: Refer to SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1. Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread, and 50 smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer. Generally,

provide liquid sealant, with or without compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are prohibited because they do not retain elasticity and bond.

2. Tape: Use only tape specifically designated by the sealant manufacturer and apply only over wet sealant. Pressure sensitive tape shall not be used on bare metal or on dry sealant.
3. Gaskets in Flanged Joints: Soft neoprene.

D. Approved factory-made joints may be used.

2.2 DUCT CONSTRUCTION AND INSTALLATION

A. Regardless of the pressure classifications outlined in the SMACNA Standards, fabricate and seal the ductwork in accordance with the following pressure classifications:

B. Duct Pressure Classification:

1. 0 to 13 mm (0 to 1/2 inch)
2. 13 mm to 25 mm (1/2 inch to 1 inch)
3. 25 mm to 50 mm (1 inch to 2 inch)
4. 50 mm to 75 mm (2 inch to 3 inch)
5. 75 mm to 100 mm (3 inch to 4 inch)

C. Seal Class: All ductwork shall receive Class A Seal.

D. Round Ducts: Furnish duct and fittings made by the same manufacturer to ensure good fit of slip joints. When submitted and approved in advance, round, with size converted on the basis of equal pressure drop, may be furnished in lieu of rectangular duct design shown in the contract documents.

1. Elbows: Diameters 75 through 200 mm (3 through 8 inches) shall be two sections die stamped, all others shall be gored construction, maximum 18 degree angle, with all seams continuously welded or standing seam. Coat galvanized areas of fittings damaged by welding with corrosion resistant aluminum paint or galvanized repair compound.
2. Provide bell mouth, conical tees or taps, laterals, reducers, and other low loss fittings as shown in SMACNA HVAC Duct Construction Standards, Metal and Flexible.
3. Ribbed Duct Option: Lighter gauge round duct and fittings may be furnished provided certified tests indicating that the rigidity and

performance is equivalent to SMACNA standard gauge ducts are submitted.

a. Ducts: Manufacturer's published standard gauge, G90 coating, spiral lock seam construction with an intermediate standing rib.

b. Fittings: May be manufacturer's standard as shown in published catalogs, fabricated by spot welding and bonding with neoprene base cement or machine formed seam in lieu of continuous welded seams.

E. Casings and Plenums: Construct in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible, including curbs, access doors, pipe penetrations, eliminators and drain pans. Access doors shall be hollow metal, insulated, with latches and door pulls, 50 cm (20 inches) wide by 122 to 137 cm (48 to 54 inches) high. Provide view port in the doors where shown. Provide drain for outside air louver plenum. Outside air plenum shall have exterior insulation. Drain piping shall be routed to the nearest floor drain.

F. Volume Dampers: Single blade or opposed blade, multi-louver type as detailed in SMACNA Standards. Refer to SMACNA for Single Blade and Multi-blade Volume Dampers.

G. Duct Hangers and Supports: Refer to SMACNA Standards. Avoid use of trapeze hangers for round duct.

2.3 DUCT ACCESS DOORS, PANELS AND SECTIONS

A. Provide access doors, sized and located for maintenance work, upstream, in the following locations:

1. Each duct mounted coil and humidifier.
2. Each fire damper (for link service), smoke damper and automatic control damper.
3. Each duct mounted smoke detector.
4. For cleaning operating room supply air duct and kitchen hood exhaust duct, locate access doors at 6.1 m (20 feet) intervals and at each change in duct direction.

B. Openings shall be as large as feasible in small ducts, 30 cm by 30 cm (12 inch by 12 inch) minimum where possible. Access sections in insulated ducts shall be double-wall, insulated. Transparent shatterproof covers are preferred for uninsulated ducts.

1. For Rectangular Ducts: Refer to SMACNA HVAC Duct Construction Standards, Metal and Flexible.

2. For Round and Flat Oval Ducts: Refer to SMACNA HVAC Duct Construction Standards, Metal and Flexible.

2.4 FLEXIBLE AIR DUCT

A. General: Factory-fabricated, complying with NFPA 90A for connectors not passing through floors of buildings. Flexible ducts shall not penetrate any fire or smoke barrier which is required to have a fire resistance rating of one hour or more. Flexible duct length shall not exceed 1.5 m (5 feet). Provide insulated acoustical air duct connectors in supply air duct systems and elsewhere as shown.

B. Flexible ducts shall be listed by Underwriters Laboratories, Inc., complying with UL 181. Ducts greater than 20 cm (8 inches) in diameter shall be Class 1. Ducts less than 20 cm (8 inches) in diameter shall be Class 1 or Class 2.

C. Insulated Flexible Air Duct: Factory-fabricated including mineral fiber insulation with maximum C factor of 0.25 at 24 degrees C (75 degrees F) mean temperature, encased with a low permeability moisture barrier outer jacket, having a puncture resistance of not less than 50 Beach Units. Acoustic insertion loss shall not be less than 3 dB per 30 cm (1 foot) of straight duct, at 500 Hz, based on 15 cm (6 inch) duct, of 762 m/min (2500 fpm).

D. Application Criteria:

1. Temperature Range: -18 to 93 degrees C (0 to 200 degrees F) internal.
2. Maximum Working Velocity: 1219 m/min (4000 fpm).
3. Minimum Working Pressure, Inches of Water Gauge: 2500 Pa (10 inches WG) positive, 500 Pa (2 inches WG) negative.

E. Duct Clamps: 100 percent nylon strap, 80 kg (176 pounds) minimum loop tensile strength manufactured for this purpose or stainless-steel strap with cadmium plated worm gear tightening device. Apply clamps with sealant and as approved for UL 181, Class 1 installation.

F. Flexible air duct is prohibited in operating room suites, SPS processing spaces, Pharmacy compounding spaces, Protective Environment spaces, Isolation Rooms, Clean Rooms, Bio-containment Laboratories, Research Laboratories, and Clinical Laboratories.

2.5 FLEXIBLE DUCT CONNECTIONS

A. Where duct connections are made to fans, air terminal units, and air handling units, install a non-combustible flexible connection of 822 g

(29 ounces) neoprene coated fiberglass fabric approximately 152 mm (6 inches) wide. For connections exposed to sun and weather provide hypalon coating in lieu of neoprene. Burning characteristics shall conform to NFPA 90A. Securely fasten flexible connections to round ducts with stainless-steel or zinc-coated iron draw bands with worm gear fastener. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 50 mm (2 inches) on center. Fabric shall not be stressed other than by air pressure. Allow at least 25 mm (one inch) slack to ensure that no vibration is transmitted.

2.6 FIRESTOPPING MATERIAL

A. Refer to Section 07 84 00, FIRESTOPPING.

2.7 SEISMIC RESTRAINT FOR DUCTWORK

A. Refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

2.8 INSTRUMENT TEST FITTINGS

A. Manufactured type with a minimum 50 mm (2 inch) length for insulated duct, and a minimum 25 mm (1 inch) length for duct not insulated. Test hole shall have a flat gasket for rectangular ducts and a concave gasket for round ducts at the base, and a screw cap to prevent air leakage.

B. Provide instrument test holes at each duct or casing mounted temperature sensor or transmitter, and at entering and leaving side of each heating coil, cooling coil, and heat recovery unit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC, particularly regarding coordination with other trades and work in existing buildings.

C. Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards:

1. Contract documents show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, boxes, diffusers,

grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the Government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes in the contract documents are inside dimensions which shall be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.

2. Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards. Provide streamliner, when an obstruction cannot be avoided and must be taken in by a duct. Repair galvanized areas with galvanizing repair compound.
3. Provide bolted construction and tie-rod reinforcement in accordance with SMACNA Standards.
4. Construct casings, eliminators, and pipe penetrations in accordance with SMACNA Standards. Design casing access doors to swing against air pressure so that pressure helps to maintain a tight seal.

D. Install duct hangers and supports in accordance with SMACNA Standards.

E. Install fire dampers and smoke dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test. Install fire dampers and smoke dampers at locations indicated and where ducts penetrate fire rated and/or smoke rated walls, shafts and where required by the COR. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges per UL and NFPA. Demonstrate resetting of fire dampers and operation of smoke dampers to the COR.

F. Seal openings around duct penetrations of floors and fire rated partitions with fire stop material as required by NFPA 90A.

G. Flexible Duct Installation: Refer to SMACNA Standards. Ducts shall be continuous, single pieces not over 1.5 m (5 feet) long per NFPA 90A, as straight and short as feasible, adequately supported. Centerline radius of bends shall be not less than two duct diameters. Make connections with clamps as recommended by SMACNA. Clamp per SMACNA with one clamp on the core duct and one on the insulation jacket. Flexible ducts shall

not penetrate floors, or any chase or partition designated as a fire or smoke barrier, including corridor partitions fire rated one hour or two hours. Support ducts SMACNA Standards.

H. Where diffusers, registers and grilles cannot be installed to avoid seeing inside the duct, paint the inside of the duct with flat black paint to reduce visibility.

I. Control Damper Installation:

1. Provide necessary blank-off plates required to install dampers that are smaller than duct size. Provide necessary transitions required to install dampers larger than duct size.
2. Assemble multiple sections dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.
3. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.
4. Install all damper control/adjustment devices on stand-offs to allow complete coverage of insulation.

J. Protection and Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition or return to source of supply for repair or replacement, as determined by COR. Protect equipment and ducts during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting. When new ducts are connected to existing ductwork, clean both new and existing ductwork by mopping and vacuum cleaning inside and outside before operation.

3.2 DUCT LEAKAGE TESTS AND REPAIR

A. Ductwork leakage testing shall be performed by the Testing and Balancing Contractor directly contracted by the General Contractor and independent of the Sheet Metal Contractor.

B. Ductwork leakage testing shall be performed for the entire air distribution system (including all supply, return, exhaust and relief ductwork), section by section, including fans, coils and filter sections.

C. Test procedure, apparatus and report shall conform to SMACNA HVAC Air Duck Leakage Test Manual. The maximum leakage rate allowed is 4 percent of the design air flow rate.

D. All ductwork shall be leak tested first before enclosed in a shaft or covered in other inaccessible areas.

E. All tests shall be performed in the presence of the COR and the Test and Balance agency. The Test and Balance agency shall measure and record duct leakage and report to the COR and identify leakage source with excessive leakage.

F. If any portion of the duct system tested fails to meet the permissible leakage level, the Contractor shall rectify sealing of ductwork to bring it into compliance and shall retest it until acceptable leakage is demonstrated to the COR.

G. All tests and necessary repairs shall be completed prior to insulation or concealment of ductwork.

H. Make sure all openings used for testing flow and temperatures by TAB Contractor are sealed properly.

3.3 TESTING, ADJUSTING, AND BALANCING (TAB)

A. Refer to Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

3.4 OPERATING AND PERFORMANCE TESTS

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

- - - E N D - - -

- - - INTENTIONALLY BLANK - - -

SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Air terminal units and air flow control valves.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

D. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

E. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

F. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

G. Section 23 31 00, HVAC DUCTS and CASINGS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. Air Conditioning, Heating, and Refrigeration Institute (AHRI):

880-2017.....Performance Rating of Air Terminals

American Society for Testing and Materials (ASTM):

C665-2017.....Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

National Fire Protection Association (NFPA):

90A-2021.....Standard for the Installation of Air-Conditioning and Ventilating Systems

Underwriters Laboratories, Inc. (UL):

181-2013(R2017).....Standard for Factory-Made Air Ducts and Air Connectors

Department of Veterans Affairs (VA):

PG-18-10-2017(R2020)....HVAC Design Manual

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE", with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Air flow control valves.

D. Samples: Provide one typical air terminal unit for approval by the COR. This unit will be returned to the Contractor after all similar units have been shipped and deemed acceptable at the job site.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

B. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 GENERAL

A. Labeling: Control box shall be clearly marked with an identification label that lists such information as nominal CFM, maximum and minimum factory-set airflow limits, coil type and coil connection orientation, where applicable.

B. Factory-calibrate air terminal units to air flow rate indicated. All settings including maximum and minimum air flow shall be field adjustable.

C. Dampers with internal air volume control, see Section 23 31 00, HVAC DUCTS and CASINGS.

D. Air terminal performance shall be in compliance with AHRI 880.

2.2 AIR TERMINAL UNITS (BOXES)

A. General: Factory-built, pressure independent units, factory set-field adjustable air flow rate, suitable for single duct applications. Use of dual-duct air terminal units is prohibited. Clearly show on each unit the unit number and factory set air volumes corresponding to the contract drawings. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC work assumes factory set air volumes. Coordinate flow controller sequence and damper operation details with the contract drawings and Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. All air terminal units shall be brand new products of the same manufacturer.

B. Capacity and Performance: The maximum capacity of a single terminal unit shall not exceed 566 Liters/second (1,200 cfm) with the exception of operating rooms and Cystoscopy rooms, which shall be served by a single air terminal unit at a maximum of 1,250 Liters/second (2,649 CFM).

C. Sound Power Levels: Acoustic performance of the air terminal units shall be based on the design noise levels for the spaces stipulated in Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT. Equipment schedule shall show the sound power levels in all octave bands. Terminal sound attenuators shall be provided, as required, to meet the intent of the design.

D. Casing: Unit casing shall be constructed of galvanized steel no lighter than 0.85 mm (22 Gauge). Provide hanger brackets for attachment of supports.

1. Lining Material: Suitable to provide required acoustic performance, thermal insulation and prevent sweating. Meet the requirements of NFPA 90A and comply with UL 181 for erosion as well as ASTM C665 antimicrobial requirements. Insulation shall consist of 13 mm (1/2 inch) thick non-porous foil faced rigid fiberglass insulation of 4-lb/cu.ft, secured by full length galvanized steel z-strips which enclose and seal all edges. Tape and adhesives shall not be used. Materials shall be non-friable and with surfaces, including all edges, fully encapsulated and faced with perforated metal or coated so that the air stream will not detach material. No lining material is permitted in the boxes serving operating rooms and Cystoscopy rooms.
2. Access Panels (or doors): Provide panels large enough for inspection, adjustment and maintenance without disconnecting ducts, and for cleaning heating coils attached to unit, even if there are no moving parts. Panels shall be insulated to same standards as the rest of the casing and shall be secured and gasketed airtight. It shall require no tool other than a screwdriver to remove.
3. Total leakage from casing, not to exceed 2 percent of the nominal capacity of the unit when subjected to a static pressure of 750 Pa (3 inches WG), with all outlets sealed shut and inlets fully open.
4. Octopus Connector: Factory installed, lined air distribution terminal. Provide where flexible duct connections are shown on the contract drawings connected directly to terminals. Provide butterfly-balancing damper, with locking means in connectors with more than one outlet. Octopus connectors and flexible connectors are prohibited in the Surgical Suite.

E. Construct dampers and other internal devices of corrosion resisting materials which do not require lubrication or other periodic maintenance.
   1. Damper Leakage: Not greater than 2 percent of maximum rated capacity, when closed against inlet static pressure of 1 kPa (4 inches WG).

F. Provide multi-point velocity pressure sensors with external pressure taps. Provide direct reading air flow rate table pasted to box.

G. Provide static pressure tubes.

H. Externally powered DDC variable air volume controller and damper actuator to be furnished under Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC for factory mounting on air terminal units. The DDC controller shall be electrically actuated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Work shall be installed as shown and according to the manufacturer’s diagrams and recommendations.

C. Handle and install units in accordance with manufacturer's written instructions.

D. Support units rigidly so they always remain stationary. Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and malfunction of units cannot occur.

E. Locate air terminal units to provide a straight section of inlet duct for proper functioning of volume controls.

3.2 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

3.3 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

- - - E N D - - -

- - - INTENTIONALLY BLANK - - -

SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Air Outlets and Inlets: Diffusers, registers, and grilles.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

D. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. Air Duct Council:

Flexible Duct Performance & Installation Standards (Manual), 5th Edition Green Book

C. American Society of Civil Engineers (ASCE):

7-2016.....Minimum Design Loads and Associated Criteria for Buildings and Other Structures

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

B209/B209M-2021.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

E. National Fire Protection Association (NFPA):

90A-2021.....Standard for the Installation of Air-Conditioning and Ventilating Systems

F. Underwriters Laboratories, Inc. (UL):

181-2013(R2017).....Standard for Factory-Made Air Ducts and Air Connectors

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE", with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Air intake/exhaust hoods.
2. Diffusers, registers, grilles, and accessories.

D. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

A. Fire Safety Code: Comply with NFPA 90A.

B. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

C. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 AIR OUTLETS AND INLETS

A. Materials:

1. Steel or aluminum Use aluminum air outlets and inlets for facilities located in high-humidity areas. Exhaust air registers

located in combination toilets and shower stalls shall be constructed from aluminum. Provide manufacturer's standard gasket.

2. Exposed Fastenings: The same material as the respective inlet or outlet. Fasteners for aluminum may be stainless-steel.
3. Contractor shall review all ceiling drawings and details and provide all ceiling mounted devices with appropriate dimensions and trim for the specific locations.

B. Performance Test Data: In accordance with Air Duct Council "Flexible Duct Performance & Installation Standards (Manual), Green Book". Refer to Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT for NC criteria.

C. Air Supply Outlets:

1. Ceiling Diffusers: Suitable for surface mounting, exposed T-bar or special tile ceilings, off-white finish, square or round neck connection as shown on the contract drawings. Provide plaster frame for units in plaster ceilings.
   a. Square, Louver, Fully Adjustable Pattern: Round neck, surface mounting unless shown otherwise on the contract drawings. Provide equalizing or control grid and volume control damper.

D. Return and Exhaust Registers and Grilles: Provide opposed blade damper without removable key operator for registers.

1. Finish: Off-white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting or shall be extruded aluminum with manufacturer's standard aluminum finish.
2. Egg Crate Grilles: Aluminum or Painted Steel 13 mm by 13 mm by 13 mm (1/2 inch by 1/2 inch by 1/2) inch grid providing 90 percent free area.
   a. Heavy extruded aluminum frame shall have countersunk screw mounting. Unless otherwise indicated, register blades and frame shall have factory applied white finish.
   b. Grille shall be suitable for duct or surface mounting as indicated on the contract drawings. All necessary appurtenances shall be provided to allow for mounting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC, particularly regarding coordination with other trades and work in existing buildings.

C. Protection and Cleaning: Protect equipment and materials against physical damage. Place equipment in first class operating condition or return to source of supply for repair or replacement, as determined by COR. Protect equipment during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting.

3.2 TESTING, ADJUSTING, AND BALANCING (TAB)

A. Refer to Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

3.3 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

- - - E N D - - -

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 conductors, cables and other items and arrangements for the specified items are shown on the drawings.

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

1.2 MINIMUM REQUIREMENTS

A. The latest International Building Code (IBC), Underwriters Laboratories, Inc. (UL), Institute of Electrical and Electronics Engineers (IEEE), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.

B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

1.3 TEST STANDARDS

A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:

1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that

maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.

2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
3. Certified: Materials and equipment which:
   a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
   b. Are periodically inspected by a NRTL.
   c. Bear a label, tag, or other record of certification.
4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)

A. Manufacturer’s Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.

B. Product Qualification:
   1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.
   2. The Government reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 APPLICABLE PUBLICATIONS

A. Applicable publications listed in all Sections of Division 26 shall be the latest issue, unless otherwise noted.

B. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

1.6 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available. Materials and equipment furnished shall be new, and shall have superior quality and freshness.

B. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer.
2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Tests are specified, Factory Tests shall be performed in the factory by the equipment manufacturer and witnessed by the contractor. In addition, the following requirements shall be complied with:

1. The Government shall have the option of witnessing factory tests. The Contractor shall notify the Government through the COR 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 additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.8 MATERIALS AND EQUIPMENT PROTECTION

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

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

1.9 WORK PERFORMANCE

A. All electrical work shall comply with requirements of the latest NFPA 70 (NEC), NFPA 70B, NFPA 70E, NFPA 99, NFPA 110, NFPA 780, OSHA Part 1910 subpart J – General Environmental Controls, OSHA Part 1910 subpart K – Medical and First Aid, and OSHA Part 1910 subpart S – Electrical, in addition to other references required by contract.

B. Job site safety and worker safety is the responsibility of the Contractor.

C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. However, energized electrical work may be performed only for the non-destructive and non-invasive diagnostic testing(s), or when scheduled outage poses an imminent hazard to patient care, safety, or physical security. In such case, all aspects of energized electrical work, such as the availability of appropriate/correct personal protective equipment (PPE) and the use of PPE, shall comply with the latest NFPA 70E, as well as the following requirements:

1. Only Qualified Person(s) shall perform energized electrical work. Supervisor of Qualified Person(s) shall witness the work of its entirety to ensure compliance with safety requirements and approved work plan.
2. At least two weeks before initiating any energized electrical work, the Contractor and the Qualified Person(s) who is designated to perform the work shall visually inspect, verify and confirm that the work area and electrical equipment can safely accommodate the work involved.
3. At least two weeks before initiating any energized electrical work, the Contractor shall develop and submit a job specific work plan, and energized electrical work request to the COR, 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.

1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working clearances shall not be less than specified in the NEC.

C. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
2. "Readily accessible” is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

D. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company’s system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company’s system, and obtain electric utility company approval for sizes and settings of these devices.

1.11 EQUIPMENT IDENTIFICATION

A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches, generators, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.

B. Identification signs for Normal Power System equipment shall be laminated 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. Submittals are required for all equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion.) associated with equipment or piping so that the proposed installation can be properly reviewed. Include sufficient fabrication information so that appropriate mounting and securing provisions may be designed and attached to the equipment.
3. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
4. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.

F. Maintenance and Operation Manuals:

1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.
3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
   a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.

b. A control sequence describing start-up, operation, and shutdown.
c. Description of the function of each principal item of equipment.
d. Installation instructions.
e. Safety precautions for operation and maintenance.
f. Diagrams and illustrations.
g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
h. Performance data.
i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

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

H. After approval and prior to installation, furnish the COR with one sample of each of the following:
1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
2. Each type of conduit coupling, bushing, and termination fitting.
3. Conduit hangers, clamps, and supports.
4. Duct sealing compound.
5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

1.13 SINGULAR NUMBER

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

1.14 ACCEPTANCE CHECKS AND TESTS

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

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

C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment and repeat the tests 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 COR for the Government.

1.16 INSTRUCTION

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

B. Furnish the services of competent and factory-trained instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be factory-trained in operating theory as well as practical operation and maintenance procedures.

C. A training schedule shall be developed and submitted by the Contractor and approved by the COR at least 30 days prior to the planned training.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

---END---

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of the electrical conductors and cables for use in electrical systems rated 600 V and below, indicated as cable(s), conductor(s), wire, or wiring in this section.

1.2 RELATED WORK

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

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for conductors and cables.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

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

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Submit the following data for approval:
      1) Electrical ratings and insulation type for each conductor and cable.
      2) Splicing materials and pulling lubricant.
2. Certifications: Two weeks prior to final inspection, submit the following:
   a. Certification by the manufacturer that the conductors and cables conform to the requirements of the drawings and specifications.

b. Certification by the Contractor that the conductors and cables have been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

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

B. American Society of Testing Material (ASTM):

D2301-10.....Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

D2304-18.....Test Method for Thermal Endurance of Rigid Electrical Insulating Materials

D3005-17.....Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

C. National Electrical Manufacturers Association (NEMA):

WC 70-21.....Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

D. National Fire Protection Association (NFPA):

70-23.....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):

44-18.....Thermoset-Insulated Wires and Cables

83-17.....Thermoplastic-Insulated Wires and Cables

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

486A-486B-18.....Wire Connectors

486C-18.....Splicing Wire Connectors

486D-15.....Sealed Wire Connector Systems

486E-15.....Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

493-18.....Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables

514B-12.....Conduit, Tubing, and Cable Fittings

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Conductors and cables shall be in accordance with ASTM, NEMA, NFPA, UL, as specified herein, and as shown on the drawings.

B. All conductors shall be copper.

C. Single Conductor and Cable:

1. No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.
2. No. 8 AWG and larger: Stranded.
3. No. 10 AWG and smaller: Solid; except shall be stranded for final connection to motors, transformers, and vibrating equipment.
4. Insulation: THHN-THWN.

D. Color Code:

1. No. 10 AWG and smaller: Solid color insulation or solid color coating.
2. No. 8 AWG and larger: Color-coded using one of the following methods:
   a. Solid color insulation or solid color coating.
   b. Stripes, bands, or hash marks of color specified.
   c. Color using 19 mm (0.75 inches) wide tape.
3. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
4. 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.		

2.2 SPLICES

A. Splices shall be in accordance with NEC and UL.

B. Above Ground Splices for No. 10 AWG and Smaller:

1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.
2. The integral insulator shall have a skirt to completely cover the stripped conductors.
3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.

C. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:

1. Compression, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
3. Splice and insulation shall be product of the same manufacturer.
4. All bolts, nuts, and washers used with splices shall be zinc-plated steel.

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

E. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

2.3 CONNECTORS AND TERMINATIONS

A. Mechanical type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.

B. All bolts, nuts, and washers used to connect connections and terminations to bus bars or other termination points shall be zinc-plated steel.

2.4 CONTROL WIRING

A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG or as required by the control wiring equipment manufacturer.

B. Control wiring shall be sized such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

2.5 WIRE LUBRICATING COMPOUND

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

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 all conductors in raceway systems.

C. Splice conductors only in outlet boxes, junction boxes, or pullboxes.

D. Conductors of different systems (e.g., 120 V and 277 V) shall not be installed in the same raceway.

E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

F. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form and train the conductors.

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. Conductor and Cable Pulling:

1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
2. Use nonmetallic pull ropes.
3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.
4. All conductors in a single conduit shall be pulled simultaneously.
5. Do not exceed manufacturer’s recommended maximum pulling tensions and sidewall pressure values.

I. Number of conductors for branch circuits shall not exceed more than three branch circuits in any one conduit.

J. When stripping stranded conductors, use a tool that does not damage the conductor or remove conductor strands.

3.2 SPLICE AND TERMINATION INSTALLATION

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

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

3.3 CONDUCTOR IDENTIFICATION

A. When using colored tape to identify phase, neutral, and ground conductors larger than No. 8 AWG, apply tape in half-overlapping turns for a minimum of 75 mm (3 inches) from terminal points, and in junction boxes and pullboxes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.

3.4 FEEDER CONDUCTOR IDENTIFICATION

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

3.5 EXISTING CONDUCTORS

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

3.6 CONTROL WIRING INSTALLATION

A. Unless otherwise specified in other sections, install control wiring and connect to equipment to perform the required functions as specified or as shown on the drawings.

B. Install a separate power supply circuit for each system, except where otherwise shown on the drawings.

3.7 CONTROL WIRING IDENTIFICATION

A. Install a permanent wire marker on each wire at each termination.

B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

C. Wire markers shall retain their markings after cleaning.

3.8 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:

1. Visual Inspection and Tests: Inspect physical condition.

---END---

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.

B. "Grounding electrode system" refers to grounding electrode conductors and all electrodes required or allowed by NEC, as well as made, supplementary, and lightning protection system grounding electrodes.

C. The terms "connect" and "bond" are used interchangeably in this section and have the same meaning.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

D. 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.

1.4 SUBMITTALS

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

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Submit plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.
2. Test Reports:
   a. Two weeks prior to the final inspection, submit ground resistance field test reports to the COR.

3. Certifications:
   a. Certification by the Contractor that the grounding equipment has been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

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

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

B1-13.....Standard Specification for Hard-Drawn Copper Wire

B3-13.....Standard Specification for Soft or Annealed Copper Wire

B8-11.....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

81-12.....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements

D. National Fire Protection Association (NFPA):

70-23.....National Electrical Code (NEC)

70E-21.....National Electrical Safety Code

99-21.....Health Care Facilities

E. Underwriters Laboratories, Inc. (UL):

44-18 .....Thermoset-Insulated Wires and Cables

83-17 .....Thermoplastic-Insulated Wires and Cables

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

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.

B. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be bare solid copper. Bonding conductors shall be stranded for final connection to motors, transformers, and vibrating equipment.

C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

D. Insulation: THHN-THWN.

2.2 GROUND CONNECTIONS

A. Below Grade and Inaccessible Locations: Exothermic-welded type connectors.

B. Above Grade:

1. Bonding Jumpers: Listed for use with aluminum and copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
2. Connection to Building Steel: Exothermic-welded type connectors.
3. Connection to Grounding Bus Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
4. Connection to Equipment Rack and Cabinet Ground Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with zinc-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.3 EQUIPMENT RACK AND CABINET GROUND BARS

A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks. Ground bars shall have minimum dimensions of 6.3 mm (0.25 inch) thick x 19 mm (0.75 inch) wide, with length as required or as shown on the drawings. Provide insulators and mounting brackets.

2.4 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.

2.5 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.

C. For patient care area electrical power system grounding, conform to the latest NFPA 70 and 99.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections, which are normally buried or otherwise inaccessible, by exothermic weld.

3.3 RACEWAY

A. Conduit Systems:

1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
3. Metallic conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a equipment grounding conductor to the equipment ground bus.

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

C. Boxes, Cabinets, Enclosures, and Panelboards:

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

D. Wireway Systems:

1. Bond the metallic structures of wireway to provide electrical continuity throughout the wireway system, by connecting a No. 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.
2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).
3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.
4. Use insulated No. 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 M (49 feet).

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

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

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

H. 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.

3.4 CORROSION INHIBITORS

A. When making grounding and bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

---END---

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.

B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

A. Section 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 raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment have been properly installed.

1.5 APPLICABLE PUBLICATIONS

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

B. American Iron and Steel Institute (AISI):

S100-16.....North American Specification for the Design of Cold-Formed Steel Structural Members

C. National Electrical Manufacturers Association (NEMA):

C80.1-20.....Electrical Rigid Steel Conduit

C80.3-20.....Steel Electrical Metal Tubing

C80.6-18.....Electrical Intermediate Metal Conduit

FB1-14.....Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

FB2.10-21.....Selection and Installation Guidelines for Fittings for use with Non-Flexible Conduit or Tubing (Rigid Metal Conduit, Intermediate Metallic Conduit, and Electrical Metallic Tubing)

FB2.20-21.....Selection and Installation Guidelines for Fittings for use with Flexible Electrical Conduit and Cable

TC-2-20.....Electrical Polyvinyl Chloride (PVC) Tubing and Conduit

TC-3-21.....PVC Fittings for Use with Rigid PVC Conduit and Tubing

D. National Fire Protection Association (NFPA):

70-23.....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):

1-05.....Flexible Metal Conduit

5-16.....Surface Metal Raceway and Fittings

6-07.....Electrical Rigid Metal Conduit - Steel

50-15.....Enclosures for Electrical Equipment

360-13.....Liquid-Tight Flexible Steel Conduit

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

514A-13.....Metallic Outlet Boxes

514B-12.....Conduit, Tubing, and Cable Fittings

514C-14.....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers

651-11.....Schedule 40 and 80 Rigid PVC Conduit and Fittings

651A-11.....Type EB and A Rigid PVC Conduit and HDPE Conduit

797-07.....Electrical Metallic Tubing

1242-14.....Electrical Intermediate Metal Conduit – Steel

PART 2 PRODUCTS

2.1 MATERIAL

A. Conduit Size: In accordance with the NEC, but not less than 19 mm (0.75-inch) unless otherwise shown. Where permitted by the NEC, 19 mm (0.75-inch) flexible conduit may be used for tap connections to recessed lighting fixtures.

B. Conduit:

1. Size: In accordance with the NEC, but not less than 19 mm (0.75-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.

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. 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.
   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.
3. Flexible Metal Conduit Fittings:
   a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
   b. Clamp-type, with insulated throat.
4. 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.

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. Conduit bodies shall only be used for changes in direction and shall not contain splices.

D. Conduit Bends:
1. Make bends with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

E. Layout and Homeruns:
1. Install conduit with wiring, including homeruns, as shown on drawings.
2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted and approved by the COR.

F. Existing conduits:
1. If existing conduits are to be used for new cabling, contractor shall clean conduit from dirt and mud, remove all unused cables before new cables can be installed.

3.2 CONCEALED WORK INSTALLATION

A. Above Furred or Suspended Ceilings and in Walls:
1. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits in the same system is prohibited.
2. Align and run conduit parallel or perpendicular to the building lines.
3. Connect recessed lighting fixtures to conduit runs with maximum 1.8 M (6 feet) of flexible metal conduit extending from a junction box to the fixture.
4. Tightening set screws with pliers is prohibited.
5. For conduits running through metal studs, limit field cut holes to no more than 70% of web depth. Spacing between holes shall be at least 457 mm (18 inches). Cuts or notches in flanges or return lips shall not be permitted.

3.3 EXPOSED WORK INSTALLATION

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

B. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. or as indicated on drawings. Mixing different types of conduits in the system is prohibited.

C. Align and run conduit parallel or perpendicular to the building lines.

D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.

E. Support horizontal or vertical runs at not over 2.4 M (8 feet) intervals.

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

3.4 MOTORS AND VIBRATING EQUIPMENT

A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.

B. Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water.

C. Provide a green equipment grounding conductor with flexible and liquid-tight flexible metal conduit.

3.5 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.

3.6 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.

3.7 BOX INSTALLATION

A. Boxes for Concealed Conduits:
   1. Flush-mounted.
   2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations or where more than the equivalent of 4-90 degree bends are necessary.

C. Locate pullboxes so that covers are accessible and easily removed. Coordinate locations with piping and ductwork where installed above ceilings.

D. Remove only knockouts as required. Plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

E. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 600 mm (24 inch) center-to-center lateral spacing shall be maintained between boxes.

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

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

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

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

---END---

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of new molded case circuit breakers in existing 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.
   b. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, circuit breakers, wiring and connection diagrams, accessories, and nameplate data.
2. Manuals:
   a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering circuit breakers and replacement parts.
      1) Include schematic diagrams, with all terminals identified, matching terminal identification in the panelboards.

2) Include information for testing, repair, troubleshooting, assembly, and disassembly.

b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certifications: Two weeks prior to final inspection, submit the following.

a. Certification by the manufacturer that the panelboards conform to the requirements of the drawings and specifications.

b. Certification by the Contractor that the panelboards have been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

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

B. International Code Council (ICC):
IBC-21.....International Building Code

C. National Electrical Manufacturers Association (NEMA):
PB 1-11.....Panelboards
250-20.....Enclosures for Electrical Equipment (1,000V Maximum)

D. National Fire Protection Association (NFPA):
70-23.....National Electrical Code (NEC)
70E-21.....Standard for Electrical Safety in the Workplace

E. Underwriters Laboratories, Inc. (UL):
50-15.....Enclosures for Electrical Equipment
67-09.....Panelboards
489-16.....Molded Case Circuit Breakers and Circuit Breaker Enclosures

PART 2 - PRODUCTS

2.1 MOLDED CASE CIRCUIT BREAKERS

A. Circuit breakers shall be per UL, NEC, as shown on the drawings, and as specified.

B. Circuit breakers shall be bolt-on type.

C. Circuit breakers shall have minimum interrupting rating as required to withstand the available fault current, but not less than:
   1. 120/208 V Panelboard: 10,000 A symmetrical.
   2. 120/240 V Panelboard: 10,000 A symmetrical.
   3. 277/480 V Panelboard: 14,000 A symmetrical.

D. Circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for less than 400 A frame. Circuit breakers with 400 A frames and above shall have magnetic trip, adjustable from 5x to 10x.

E. Circuit breaker features shall be as follows:
   1. A rugged, integral housing of molded insulating material.
   2. Silver alloy contacts.
   3. Arc quenchers and phase barriers for each pole.
   4. Quick-make, quick-break, operating mechanisms.
   5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
   6. Electrically and mechanically trip free.
   7. An operating handle which indicates closed, tripped, and open positions.
   8. An overload on one pole of a multi-pole breaker shall automatically cause all the poles of the breaker to open.
   9. Ground fault current interrupting breakers, shunt trip breakers, lighting control breakers (including accessories to switch line currents), or other accessory devices or functions shall be provided where shown on the drawings.
   10. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory accordingly.

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. 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

C. 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. Inspect physical, electrical, and mechanical condition.

b. To verify tightness of accessible bolted electrical connections, use the calibrated torque-wrench method or perform thermographic survey after energization.

c. Vacuum-clean enclosure interior. Clean enclosure exterior.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks, settings, and tests, the Contractor shall demonstrate that the panelboards are in good operating condition and properly performing the intended function.

---END---

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of wiring devices.

1.2 RELATED WORK

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

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Cables and wiring.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

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

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Include electrical ratings, dimensions, mounting details, construction materials, grade, and termination information.
2. Manuals:
   a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and information for ordering replacement parts.
   b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the wiring devices conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the wiring devices have been properly installed and adjusted.

1.5 APPLICABLE PUBLICATIONS

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

B. National Electrical Manufacturers Association (NEMA):
   WD 1-99(R2015).....General Color Requirements for Wiring Devices
   WD 6-16 .....Wiring Devices – Dimensional Specifications

C. National Fire Protection Association (NFPA):
   70-23.....National Electrical Code (NEC)
   99-24.....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. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The lower receptacle shall be unswitched.
3. Ground Fault Current Interrupter (GFCI) Duplex Receptacles: Shall be an integral unit, hospital-grade, suitable for mounting in a standard outlet box, with end-of-life indication and provisions to isolate the face due to improper wiring. GFCI receptacles shall be self-test receptacles in accordance with UL 943.
   a. Ground fault interrupter shall consist of a differential current transformer, self-test, solid state sensing circuitry and a circuit interrupter switch. Device shall have nominal sensitivity to ground leakage current of 4-6 milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or – 1 milliampere) on the load side of the device. Device shall have a minimum nominal tripping time of 0.025 second.
   b. Self-test function shall be automatically initiated within 5 seconds after power is activated to the receptacles. Self-test function shall be periodically and automatically performed every 3 hours or less.
   c. End-of-life indicator light shall be a persistent flashing or blinking light to indicate that the GFCI receptacle is no longer in service.

C. Receptacles - 20, 30, and 50 ampere, 250 Volts: Shall be complete with appropriate cord grip plug.

2.4 WALL PLATES

A. Wall plates for receptacles shall be type 302 stainless steel. Oversize plates are not acceptable.

B. For receptacles mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.

C. Duplex Receptacles on Emergency Circuit: Wall plates shall be type 302 stainless steel, with the word “EMERGENCY” engraved in 6 mm (1/4 inch) red letters.

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. Provide barriers in multi-gang outlet boxes to comply with the NEC.

E. 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.

F. 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.

G. 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.

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

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

J. Label device plates with a permanent adhesive label listing panel and circuit feeding the wiring device.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform manufacturer’s required field checks in accordance with the manufacturer's recommendations, and the latest NFPA 99. In addition, include the following:

1. Visual Inspection and Tests:
   a. Inspect physical and electrical conditions.
   b. 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.
   c. Test GFCI receptacles.

---END---

---INTENTIONALLY BLANK---

SECTION 27 05 11
REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes common requirements to communications installations and applies to all sections of Division 27 and Division 28.

B. Provide completely functioning communications systems.

C. Comply with VAAR 852.236.91 and FAR clause 52.236-21 in circumstance of a need for additional detail or conflict between drawings, specifications, reference standards or code.

1.2 REFERENCES

A. Abbreviations and Acronyms

1. Refer to http://www.cfm.va.gov/til/sdetail.asp for Division 00, ARCHITECTURAL ABBREVIATIONS.
2. Additional Abbreviations and Acronyms:

A	Ampere
AC	Alternating Current
AE	Architect and Engineer
AFF	Above Finished Floor
AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute
AWG	American Wire Gauge (refer to STP and UTP)
AWS	Advanced Wireless Services
BCT	Bonding Conductor for Telecommunications (also Telecommunications Bonding Conductor (TBC))
BDA	Bi-Directional Amplifier
BICSI	Building Industry Consulting Service International
BIM	Building Information Modeling
BOM	Bill of Materials
BTU	British Thermal Units
BUCR	Back-up Computer Room
BTS	Base Transceiver Station
CAD	AutoCAD
CBOPC	Community Based Out Patient Clinic

CBC	Coupled Bonding Conductor
CBOC	Community Based Out Patient Clinic (refer to CBOPC, OPC, VAMC)
CCS	TIP's Cross Connection System (refer to VCCS and HCCS)
CFE	Contractor Furnished Equipment
CFM	US Department of Veterans Affairs Office of Construction and Facilities Management
CFR	Consolidated Federal Regulations
CIO	Communication Information Officer (Facility, VISN or Region)
cm	Centimeters
CO	Central Office
COR	Contracting Officer Representative
CPU	Central Processing Unit
CSU	Customer Service Unit
CUP	Conditional Use Permit(s) – Federal/GSA for VA
dB	Decibel
dBm	Decibel Measured
dBmV	Decibel per milli-Volt
DC	Direct Current
DEA	United States Drug Enforcement Administration
DSU	Data Service Unit
EBC	Equipment Bonding Conductor
ECC	Engineering Control Center (refer to DCR, EMCR)
EDGE	Enhanced Data (Rates) for GSM Evolution
EDM	Electrical Design Manual
EMCR	Emergency Management Control Room (refer to DCR, ECC)
EMI	Electromagnetic Interference (refer to RFI)
EMS	Emergency Medical Service
EMT	Electrical Metallic Tubing or thin wall conduit
ENTR	Utilities Entrance Location (refer to DEMARC, POTS, LEC)
EPBX	Electronic Digital Private Branch Exchange
ESR	Vendor’s Engineering Service Report

FA	Fire Alarm
FAR	Federal Acquisition Regulations in Chapter 1 of Title 48 of Code of Federal Regulations
FMS	VA's Headquarters or Medical Center Facility's Management Service
FR	Frequency (refer to RF)
FTS	Federal Telephone Service
GFE	Government Furnished Equipment
GPS	Global Positioning System
GRC	Galvanized Rigid Metal Conduit
GSM	Global System (Station) for Mobile
HCCS	TIP's Horizontal Cross Connection System (refer to CCS & VCCS)
HDPE	High Density Polyethylene Conduit
HDTV	Advanced Television Standards Committee High-Definition Digital Television
HEC	Head End Cabinets (refer to HEIC, PA)
HEIC	Head End Interface Cabinets (refer to HEC, PA)
HF	High Frequency (Radio Band; Re FR, RF, VHF & UHF)
HSPA	High Speed Packet Access
HZ	Hertz
IBT	Intersystem Bonding Termination (NEC 250.94)
IC	Intercom
ICRA	Infectious Control Risk Assessment
IDEN	Integrated Digital Enhanced Network
IDC	Insulation Displacement Contact
IDF	Intermediate Distribution Frame
ILSM	Interim Life Safety Measures
IMC	Rigid Intermediate Steel Conduit
IRM	Department of Veterans Affairs Office of Information Resources Management
ISDN	Integrated Services Digital Network
ISM	Industrial, Scientific, Medical

IWS	Intra-Building Wireless System
LAN	Local Area Network
LBS	Location Based Services, Leased Based Systems
LEC	Local Exchange Carrier (refer to DEMARC, PBX & POTS)
LED	Light Emitting Diode
LMR	Land Mobile Radio
LTE	Long Term Evolution, or 4G Standard for Wireless Data Communications Technology
M	Meter
MAS	Medical Administration Service
MATV	Master Antenna Television
MCR	Main Computer Room
MCOR	Main Computer Operators Room
MDF	Main Distribution Frame
MH	Manholes or Maintenance Holes
MHz	Megahertz (10^6 Hz)
mm	Millimeter
MOU	Memorandum of Understanding
MW	Microwave (RF Band, Equipment or Services)
NID	Network Interface Device (refer to DEMARC)
NEC	National Electric Code
NOR	Network Operations Room
NRTL	OSHA Nationally Recognized Testing Laboratory
NS	Nurse Stations
NTIA	U.S. Department of Commerce National Telecommunications and Information Administration
OEM	Original Equipment Manufacturer
OI&T	Office of Information and Technology
OPC	VA’s Outpatient Clinic (refer to CBOC, VAMC)
OSH	Department of Veterans Affairs Office of Occupational Safety and Health
OSHA	United States Department of Labor Occupational Safety and Health Administration

OTDR	Optical Time-Domain Reflectometer
PA	Public Address System (refer to HE, HEIC, RPEC)
PBX	Private Branch Exchange (refer to DEMARC, LEC, POTS)
PCR	Police Control Room (refer to SPCC, could be designated SCC)
PCS	Personal Communications Service (refer to UPCS)
PE	Professional Engineer
PM	Project Manager
PoE	Power over Ethernet
POTS	Plain Old Telephone Service (refer to DEMARC, LEC, PBX)
PSTN	Public Switched Telephone Network
PSRAS	Public Safety Radio Amplification Systems
PTS	Pay Telephone Station
PVC	Poly-Vinyl Chloride
PWR	Power (in Watts)
RAN	Radio Access Network
RBB	Rack Bonding Busbar
RF	Radio Frequency (refer to FR)
RFI	Radio Frequency Interference (refer to EMI)
RFID	RF Identification (Equipment, System or Personnel)
RMC	Rigid Metal Conduit
RMU	Rack Mounting Unit
RPEC	Radio Paging Equipment Cabinets (refer to HEC, HEIC, PA)
RTLS	Real Time Location Service or System
RUS	Rural Utilities Service
SCC	Security Control Console (refer to PCR, SPCC)
SMCS	Spectrum Management and Communications Security (COMSEC)
SFO	Solicitation for Offers
SME	Subject Matter Experts (refer to AHJ)
SMR	Specialized Mobile Radio
SMS	Security Management System
SNMP	Simple Network Management Protocol
SPCC	Security Police Control Center (refer to PCR, SMS)

STP	Shielded Balanced Twisted Pair (refer to UTP)
STR	Stacked Telecommunications Room
TAC	VA's Technology Acquisition Center, Austin, Texas
TCO	Telecommunications Outlet
TER	Telephone Equipment Room
TGB	Telecommunications Grounding Busbar (also Secondary Bonding Busbar (SBB))
TIP	Telecommunications Infrastructure Plant
TMGB	Telecommunications Main Grounding Busbar (also Primary Bonding Busbar (PBB))
TMS	Traffic Management System
TOR	Telephone Operators Room
TP	Balanced Twisted Pair (refer to STP and UTP)
TR	Telecommunications Room (refer to STR)
TWP	Twisted Pair
UHF	Ultra-High Frequency (Radio)
UMTS	Universal Mobile Telecommunications System
UPCS	Unlicensed Personal Communications Service (refer to PCS)
UPS	Uninterruptible Power Supply
USC	United States Code
UTP	Unshielded Balanced Twisted Pair (refer to TP and STP)
UV	Ultraviolet
V	Volts
VAAR	Veterans Affairs Acquisition Regulation
VACO	Veterans Affairs Central Office
VAMC	VA Medical Center (refer to CBOC, OPC, VACO)
VCCS	TIP's Vertical Cross Connection System (refer to CCS and HCCS)
VHF	Very High Frequency (Radio)
VISN	Veterans Integrated Services Network (refers to geographical region)
VSWR	Voltage Standing Wave Radio

W	Watts
WEB	World Electronic Broadcast
WiMAX	Worldwide Interoperability (for MW Access)
WI-FI	Wireless Fidelity
WMTS	Wireless Medical Telemetry Service
WSP	Wireless Service Providers

B. Definitions:

1. Access Floor: Pathway system of removable floor panels supported on adjustable pedestals to allow cable placement in area below.
2. BNC Connector (BNC): United States Military Standard MIL-C-39012/21 bayonet-type coaxial connector with quick twist mating/unmating, and two lugs preventing accidental disconnection from pulling forces on cable.
3. Bond: Permanent joining of metallic parts to form an electrically conductive path to ensure electrical continuity and capacity to safely conduct any currents likely to be imposed to earth ground.
4. Bundled Microducts: All forms of jacketed microducts.
5. Conduit: Includes all raceway types specified.
6. Conveniently Accessible: Capable of being reached without use of ladders, or without climbing or crawling under or over obstacles such as, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.
7. DEMARC, Extended DMARC or ENTR: Service provider's main point of demarcation owned by LEC or service provider and establishes a physical point where service provider's responsibilities for service and maintenance end. This point is called NID, in data networks.
8. Effectively Grounded: Intentionally bonded to earth through connections of low impedance having current carrying capacity to prevent buildup of currents and voltages resulting in hazard to equipment or persons.
9. Electrical Supervision: Analyzing a system’s function and components (i.e. cable breaks / shorts, inoperative stations, lights, LEDs and states of change, from primary to backup) on a 24/7/365 basis; provide aural and visual emergency notification signals to minimum two remote designated or accepted monitoring stations.

10. Electrostatic Interference (ESI) or Electrostatic Discharge Interference: Refer to EMI and RFI.
11. Project 25 (2014) (P25 (TIA-102 Series)): Set of standards for local, state and Federal public safety organizations and agencies digital LMR services. P25 is applicable to LMR equipment authorized or licensed under the US Department of Commerce National Telecommunications and Information Administration or FCC rules and regulations and is a required standard capability for all LMR equipment and systems.
12. Grounding Electrode Conductor: (GEC) Conductor connected to earth grounding electrode.
13. Grounding Electrode System: Electrodes through which an effective connection to earth is established, including supplementary, communications system grounding electrodes and GEC.
14. Grounding Equalizer or Backbone Bonding Conductor (BBC): Conductor that interconnects elements of telecommunications grounding infrastructure.
15. Head End (HE): Equipment, hardware and software, or a master facility at originating point in a communications system designed for centralized communications control, signal processing, and distribution that acts as a common point of connection between equipment and devices connected to a network of interconnected equipment, possessing greatest authority for allowing information to be exchanged, with whom other equipment is subordinate.
16. Microducts: All forms of air blown fiber pathways.
17. Ohm: A unit of restive measurement.
18. Received Signal Strength Indication (RSSI): A measurement of power present in a received RF signal.
19. Service Provider Demarcation Point (SPDP): Not owned by LEC or service provider but designated by Government as point within facility considered the DEMARC.
20. Sound (SND): Changing air pressure to audible signals over given time span.
21. System: Specific hardware, firmware, and software, functioning together as a unit, performing task for which it was designed.
22. Telecommunications Bonding Backbone (TBB): Conductors of appropriate size (minimum 53.49 mm2 [1/0 AWG]) stranded copper wire, that connect

to Grounding Electrode System and route to telecommunications main grounding busbar (TMGB) and circulate to interconnect various TGBs and other locations shown on drawings.

23. Wide Area Network (WAN): A digital network that transcends localized LANs within a given geographic location. VA'S WAN/LAN is not nationally listed or coded for life and public safety, critical, emergency or other safety functions.

1.3 APPLICABLE PUBLICATIONS

A. Applicability of Standards: Unless documents include more stringent requirements, applicable construction industry standards have same force and effect as if bound or copied directly into the documents to extent referenced. Such standards are made a part of these documents by reference.

1. Each entity engaged in construction shall be familiar with industry standards applicable to its construction activity.
2. Obtain standards directly from publication source, where copies of standards are needed to perform a required construction activity.

B. Government Codes, Standards and Executive Orders: Refer to http://www.cfm.va.gov/TIL/cPro.asp:

1. Federal Communications Commission, (FCC) CFR, Title 47:

Part 15.....Restrictions of use for Part 15 listed RF Equipment in Safety of Life Emergency Functions and Equipment Locations

Part 47.....Chapter A, Paragraphs 6.1-6.23, Access to Telecommunications Service, Telecommunications Equipment and Customer Premises Equipment

Part 58.....Television Broadcast Service

Part 73.....Radio and Television Broadcast Rules

Part 90.....Rules and Regulations, Appendix C

Form 854.....Antenna Structure Registration

Chapter XXIII .....National Telecommunications and Information Administration (NTIA, P/O Commerce, Chapter XXIII) the 'Red Book'- Chapters 7, 8 & 9 compliments CFR, Title 47, FCC Part 15, RF Restriction of Use and Compliance in "Safety of Life" Functions & Locations

2. US Department of Agriculture, (Title 7, USC, Chapter 55, Sections 2201, 2202 & 2203:

RUS 1755.....Telecommunications Standards and Specifications for Materials, Equipment and Construction:

RUS Bull 1751F-630...Design of Aerial Cable Plants

RUS Bull 1751F-640...Design of Buried Cable Plant, Physical Considerations

RUS Bull 1751F-643...Underground Plant Design

RUS Bull 1751F-815...Electrical Protection of Outside Plants,

RUS Bull 1753F-201...Acceptance Tests of Telecommunications Plants (PC-4)

RUS Bull 1753F-401...Splicing Copper and Fiber Optic Cables (PC-2)

RUS Bull 345-50.....Trunk Carrier Systems (PE-60)

RUS Bull 345-65 .....Shield Bonding Connectors (PE-65)

RUS Bull 345-72 .....Filled Splice Closures (PE-74)

RUS Bull 345-83 .....Gas Tube Surge Arrestors (PE-80)

3. US Department of Commerce/National Institute of Standards Technology(NIST):

FIPS PUB 1-1.....Telecommunications Information Exchange

FIPS PUB 100/1.....Interface between Data Terminal Equipment (DTE) Circuit Terminating Equipment for operation with Packet Switched Networks, or Between Two DTEs, by Dedicated Circuit

FIPS PUB 140/2.....Telecommunications Information Security Algorithms

FIPS PUB 143 .....General Purpose 37 Position Interface between DTE and Data Circuit Terminating Equipment

FIPS 160/2.....Electronic Data Interchange (EDI),

FIPS 175.....Federal Building Standard for Telecommunications Pathway and Spaces

FIPS 191.....Guideline for the Analysis of Local Area Network Security

FIPS 197.....Advanced Encryption Standard (AES)

FIPS 199.....Standards for Security Categorization of Federal Information and Information Systems

4. US Department of Defense, (DoD):

   MIL-STD-188-110.....Interoperability and Performance Standards for Data Modems

   MIL-STD-188-114.....Electrical Characteristics of Digital Interface Circuits

   MIL-STD-188-115.....Communications Timing and Synchronizations Subsystems

   MIL-C-28883.....Advanced Narrowband Digital Voice Terminals

   MIL-C-39012/21.....Connectors, Receptacle, Electrical, Coaxial, Radio Frequency, (Series BNC (Uncabled), Socket Contact, Jam Nut Mounted, Class 2)

5. US Department of Health and Human Services:

   The Health Insurance Portability and Accountability Act of 1996 (HIPAA) Privacy, Security and Breach Notification Rules

6. US Department of Justice:

   2010 Americans with Disabilities Act Standards for Accessible Design (ADAAD).

7. US Department of Labor, (DoL) - Public Law 426-62 – CFR, Title 29, Part 1910, Chapter XVII - Occupational Safety and Health Administration (OSHA), Occupational Safety and Health Standards):

   Subpart 7 .....Approved NRTLs; obtain a copy at http://www.osha.gov/dts/otpca/nrtl/faq_nrtl.html)

   Subpart 35.....Compliance with NFPA 101, Life Safety Code

   Subpart 36.....Design and Construction Requirements for Exit Routes

   Subpart 268.....Telecommunications

   Subpart 305.....Wiring Methods, Components, and Equipment for General Use

   Subpart 508 .....Americans with Disabilities Act Accessibility Guidelines; technical requirement for accessibility to buildings and facilities by individuals with disabilities

8. US Department of Transportation, (DoT):

   a. Public Law 85-625, CFR, Title 49, Part 1, Subpart C – Federal Aviation Administration (FAA):AC 110/460-ID & AC 707 / 460-2E – Advisory Circulars Standards for Construction of Antenna Towers, and 7450 and 7460-2 – Antenna Construction Registration Forms.

9. US Department of Veterans Affairs (VA): Office of Telecommunications (OI&T), MP-6, PART VIII, TELECOMMUNICATIONS, CHAPTER 5, AUDIO, RADIO AND TELEVISION (and COMSEC) COMMUNICATIONS SYSTEMS: Spectrum Management and COMSEC Service (SMCS), AHJ for:
   a. CoG, "Continuance of Government" communications guidelines and compliance.
   b. COMSEC, "VA wide coordination and control of security classified communication assets."
   c. COOP, "Continuance of Operations" emergency communications guidelines and compliance.
   d. FAA, FCC, and US Department of Commerce National Telecommunications and Information Administration, "VA wide RF Co-ordination, Compliance and Licensing."
   e. Handbook 6100 – Telecommunications: Cyber and Information Security Office of Cyber and Information Security, and Handbook 6500 – Information Security Program.
   f. Low Voltage Special Communications Systems "Design, Engineering, Construction Contract Specifications and Drawings Conformity, Proof of Performance Testing, VA Compliance and Life Safety Certifications for CFM and VA Facility Low Voltage Special Communications Projects (except Fire Alarm, Telephone and Data Systems)."
   g. SATCOM, "Satellite Communications" guidelines and compliance, and Security and Law Enforcement Systems – "Coordinates the Design, Engineering, Construction Contract Specifications and Drawings Conformity, Proof of Performance Testing, VA Compliance, DEA and Public Safety Certification(s) for CFM and VA Facility Security Low Voltage Special Communications and Physical Security Projects.
   h. VHA's National Center for Patient Safety – Veterans Health Administration (VHA) Warning System, Failure of Medical Alarm Systems using Paging Technology to Notify Clinical Staff, July 2004.
   i. VA's CEOSH, concurrence with warning identified in VA Directive 7700.
   j. Wireless and Handheld Devices, "Guidelines and Compliance,"

k. Office of Security and Law Enforcement: VA Directive 0730 and Health Special Presidential Directive (HSPD)-12.

C. NRTL Standards: Refer to https://www.osha.gov/dts/otpca/nrtl/index.html

1. Canadian Standards Association (CSA); same tests as presented by UL
2. Communications Certifications Laboratory (CEL); same tests as presented by UL.
3. Intertek Testing Services NA, Inc., (ITSNA), formerly Edison Testing Laboratory (ETL) same tests as presented by UL).
4. Underwriters Laboratory (UL):

1-2005.....Flexible Metal Conduit
5-2011.....Surface Metal Raceway and Fittings
6-2007.....Rigid Metal Conduit
44-010 .....Thermoset-Insulated Wires and Cables
50-1995.....Enclosures for Electrical Equipment
65-2010.....Wired Cabinets
83-2008.....Thermoplastic-Insulated Wires and Cables
96-2005.....Lightning Protection Components
96A-2007.....Installation Requirements for Lightning Protection Systems
360-2013.....Liquid-Tight Flexible Steel Conduit
444-2008.....Communications Cables
467-2013.....Grounding and Bonding Equipment
486A-486B-2013.....Wire Connectors
486C-2013.....Splicing Wire Connectors
486D-2005.....Sealed Wire Connector Systems
486E-2009.....Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
493-2007.....Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable
497/497A/497B/497C
497D/497E.....Protectors for Paired Conductors/Communications Circuits/Data Communications and Fire Alarm Circuits/coaxial circuits/voltage protections/Antenna Lead In
510-2005.....Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
514A-2013.....Metallic Outlet Boxes

514B-2012.....Fittings for Cable and Conduit

514C-1996.....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers

651-2011.....Schedule 40 and 80 Rigid PVC Conduit

651A-2011.....Type EB and A Rigid PVC Conduit and HDPE Conduit

797-2007.....Electrical Metallic Tubing

884-2011.....Underfloor Raceways and Fittings

1069-2007.....Hospital Signaling and Nurse Call Equipment

1242-2006.....Intermediate Metal Conduit

1449-2006.....Standard for Transient Voltage Surge Suppressors

1479-2003.....Fire Tests of Through-Penetration Fire Stops

1480-2003.....Speaker Standards for Fire Alarm, Emergency, Commercial and Professional use

1666-2007.....Standard for Wire/Cable Vertical (Riser) Tray Flame Tests

1685-2007.....Vertical Tray Fire Protection and Smoke Release Test for Electrical and Fiber Optic Cables

1861-2012.....Communication Circuit Accessories

1863-2013.....Standard for Safety, communications Circuits Accessories

1865-2007.....Standard for Safety for Vertical-Tray Fire Protection and Smoke-Release Test for Electrical and Optical-Fiber Cables

2024-2011.....Standard for Optical Fiber Raceways

2024-2014.....Standard for Cable Routing Assemblies and Communications Raceways

2196-2001.....Standard for Test of Fire Resistive Cable

60950-1 ed. 2-2014...Information Technology Equipment Safety

D. Industry Standards:

1. Advanced Television Systems Committee (ATSC):

A/53 Part 1: 2013....ATSC Digital Television Standard, Part 1, Digital Television System

A/53 Part 2: 2011....ATSC Digital Television Standard, Part 2, RF/Transmission System Characteristics

A/53 Part 3: 2013....ATSC Digital Television Standard, Part 3, Service Multiplex and Transport System Characteristics

A/53 Part 4: 2009....ATSC Digital Television Standard, Part 4, MPEG-2 Video System Characteristics

A/53 Part 5: 2014....ATSC Digital Television Standard, Part 5, AC-3 Audio System Characteristics

A/53 Part 6: 2014....ATSC digital Television Standard, Part 6, Enhanced AC-3 Audio System Characteristics

2. American Institute of Architects (AIA): 2006 Guidelines for Design & Construction of Health Care Facilities.
3. American Society of Mechanical Engineers (ASME):

A17.1 (2016).....Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices

17.3 (2011).....Safety Code for Existing Elevators and Escalators

17.4 (2009).....Guide for Emergency Personnel

17.5 (2011).....Elevator and Escalator Electrical Equipment

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

B1 (2001).....Standard Specification for Hard-Drawn Copper Wire

B8 (2004).....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

D1557 (2012).....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft-lbf/ft3 (2,700 kN-m/m3)

D2301 (2004).....Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape

B258-02 (2008).....Standard Specification for Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors

D709-01(2007).....Standard Specification for Laminated Thermosetting Materials

D4566 (2008).....Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable

5. American Telephone and Telegraph Corporation (AT&T) - Obtain following AT&T Publications at https://ebiznet.sbc.com/SBCNEBS/):

ATT-TP-76200 (2013)..Network Equipment and Power Grounding, Environmental, and Physical Design Requirements

ATT-TP-76300(2012)...Merged AT&T Affiliate Companies Installation Requirements

ATT-TP-76305 (2013)..Common Systems Cable and Wire Installation and Removal Requirements - Cable Racks and Raceways

ATT-TP-76306 (2009)..Electrostatic Discharge Control

ATT-TP-76400 (2012)..Detail Engineering Requirements

ATT-TP-76402 (2013)..AT&T Raised Access Floor Engineering and Installation Requirements

ATT-TP-76405 (2011)..Technical Requirements for Supplemental Cooling Systems in Network Equipment Environments

ATT-TP-76416 (2011)..Grounding and Bonding Requirements for Network Facilities

ATT-TP-76440 (2005)..Ethernet Specification

ATT-TP-76450 (2013)..Common Systems Equipment Interconnection Standards for AT&T Network Equipment Spaces

ATT-TP-76461 (2008)..Fiber Optic Cleaning

ATT-TP-76900 (2010)..AT&T Installation Testing Requirement

ATT-TP-76911 (1999)..AT&T LEC Technical Publication Notice

6. British Standards Institution (BSI):

BS EN 50109-2.....Hand Crimping Tools - Tools for The Crimp Termination of Electric Cables and Wires for Low Frequency and Radio Frequency Applications – All Parts & Sections. October 1997

7. Building Industry Consulting Service International(BICSI):

ANSI/BICSI 013-2014..Telecommunications Distribution Method manual

ANSI/BICSI 002-2011..Data Center Design and Implementation Best Practices

ANSI/BICSI 004-2012..Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities

ANSI/NECA/BICSI 568-2006.....Standard for Installing Commercial Building Telecommunications Cabling

NECA/BICSI 607-2011..Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

ANSI/BICSI 005-2013 .Electronic Safety and Security (ESS) System Design and Implementation Best Practices

8. Electronic Components Assemblies and Materials Association, (ECA).

ECA EIA/RS-270 (1973) Tools, Crimping, Solderless Wiring Devices – Recommended Procedures for User Certification

EIA/ECA 310-E (2005).Cabinets, and Associated Equipment

9. Facility Guidelines Institute: 2010 Guidelines for Design and Construction of Health Care Facilities.

10. Insulated Cable Engineers Association (ICEA):

ANSI/ICEA S-80-576-2002.....Category 1 & 2 Individually Unshielded Twisted-Pair Indoor Cables for Use in Communications Wiring Systems

ANSI/ICEA S-84-608-2010.....Telecommunications Cable, Filled Polyolefin Insulated Copper Conductor, S-87-640(2011) Optical Fiber Outside Plant Communications Cable

ANSI/ICEA S-90-661-2012.....Category 3, 5, & 5e Individually Unshielded Twisted-Pair Indoor Cable for Use in General Purpose and LAN Communication Wiring Systems

S-98-688 (2012).....Broadband Twisted Pair Cable Aircore, Polyolefin Insulated, Copper Conductors

S-99-689 (2012).....Broadband Twisted Pair Cable Filled, Polyolefin Insulated, Copper Conductors

ICEA S-102-700

(2004).....Category 6 Individually Unshielded Twisted Pair Indoor Cables (With or Without an Overall Shield) for use in Communications Wiring Systems Technical Requirements

11. Institute of Electrical and Electronics Engineers (IEEE):

ISSN 0739-5175 .....March-April 2008 Engineering in Medicine and Biology Magazine, IEEE (Volume: 27, Issue:2) Medical Grade-Mission Critical-Wireless Networks

IEEE C2-2012.....National Electrical Safety Code (NESC) C62.41.2-2002/

Cor 1-2012 IEEE .....Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits 4)

C62.45-2002.....IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits

81-2012 IEEE.....Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System

100-1992.....IEEE the New IEEE Standards Dictionary of Electrical and Electronics Terms

602-2007.....IEEE Recommended Practice for Electric Systems in Health Care Facilities

1100-2005.....IEEE Recommended Practice for Powering and Grounding Electronic Equipment

12. International Code Council:

AC193 (2014).....Mechanical Anchors in Concrete Elements

13. International Organization for Standardization (ISO):

ISO/TR 21730 (2007)..Use of Mobile Wireless Communication and Computing Technology in Healthcare Facilities - Recommendations for Electromagnetic Compatibility (Management of Unintentional Electromagnetic Interference) with Medical Devices

14. National Electrical Manufacturers Association (NEMA):

NEMA 250 (2008).....Enclosures for Electrical Equipment (1,000V Maximum)

ANSI C62.61 (1993)...American National Standard for Gas Tube Surge Arresters on Wire Line Telephone Circuits

ANSI/NEMA FB 1 (2012) ...Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing EMT) and Cable

ANSI/NEMA OS 1 (2009) ...Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports

NEMA SB 19 (R2007)...NEMA Installation Guide for Nurse Call Systems

TC 3 (2004).....Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing

NEMA VE 2 (2006).....Cable Tray Installation Guidelines

15. National Fire Protection Association (NFPA):

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

70-2020.....National Electrical Code (NEC)

72-2019.....National Fire Alarm Code

75-2017.....Standard for the Fire Protection of Information Technological Equipment

76-2016.....Recommended Practice for the Fire Protection of Telecommunications Facilities

77-2019.....Recommended Practice on Static Electricity

90A-2018.....Standard for the Installation of Air Conditioning and Ventilating Systems

99-2018.....Health Care Facilities Code

101-2018.....Life Safety Code

241-2019.....Safeguarding construction, alternation and Demolition Operations

255-2009.....Standard Method of Test of Surface Burning Characteristics of Building Materials

262 - 2019.....Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces

780-2017.....Standard for the Installation of Lightning Protection Systems

1221-2019.....Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems

5000-2018.....Building Construction and Safety Code

16. Society for Protective Coatings (SSPC):

SSPC SP 6/NACE No.3 (2007) Commercial Blast Cleaning

17. Society of Cable Telecommunications Engineers (SCTE):

ANSI/SCTE 15 2006 ...Specification for Trunk, Feeder and Distribution Coaxial Cable

18. Telecommunications Industry Association (TIA):

TIA-120 Series.....Telecommunications Land Mobile communications (APCO/Project 25) (January 2014)

TIA TSB-140.....Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems (2004)

TIA-155.....Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T (2010)

TIA TSB-162-A.....Telecommunications Cabling Guidelines for Wireless Access Points (2013)

TIA-222-G.....Structural Standard for Antenna Supporting Structures and Antennas (2014)

TIA/EIA-423-B.....Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits (2012)

TIA-455-C.....General Requirements for Standard Test Procedures for Optical Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components (August 2014)

TIA-455-53-A.....FOTP-53 Attenuation by Substitution Measurements for Multimode Graded-Index Optical Fibers in Fiber Assemblies (Long Length) (September 2001)

TIA-455-61-A.....FOTP-61 Measurement of Fiber of Cable Attenuation Using an OTDR (July 2003)

TIA-472D000-B.....Fiber Optic Communications Cable for Outside Plant Use (July 2007)

ANSI/TIA-492-B .....62.5-µ Core Diameter/125-um Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers (November 2009)

ANSI/TIA-492AAAB-A ..50-um Core Diameter/125-um Cladding Diameter Class IA Graded-Index Multimode Optically Optimized American Standard Fibers (November 2009

TIA-492CAAA.....Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers (September 2002)

TIA-492E000.....Sectional Specification for Class IVd Nonzero-Dispersion Single-Mode Optical Fibers for the 1,550 nm Window (September 2002)

TIA-526-7-B.....Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant – OFSTP-7 (December 2008)

TIA-526.14-A.....Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – SFSTP-14 (August 1998)

TIA 526-7 Measurement of Optical Power Loss of Installed Single-mode Fiber Cable Plant

TIA-568.....Revision/Edition: C Commercial Building Telecommunications Cabling Standard Set: (TIA-568-C.0-2 Generic Telecommunications Cabling for Customer Premises (2012), TIA-568-C.1-1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements (2012), TIA-568-C.2 Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted Pair Cabling Components (2009), TIA-568-C.3-1 Optical Fiber Cabling Components Standard, (2011) AND TIA-568-C.4 Broadband Coaxial Cabling and Components Standard (2011) with addendums and erratas

TIA-569.....Revision/Edition C Telecommunications Pathways and Spaces (March 2013)

TIA-574.....Position Non-Synchronous Interface between Data Terminal equipment and Data Circuit Terminating Equipment Employing Serial Binary Interchange (May 2003)

TIA/EIA-590-A.....Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant (July 2001)

TIA-598-D.....Optical Fiber Cable Color Coding (January 2005)

TIA-604-10-B.....Fiber Optic Connector Intermateablility Standard (August 2008)

ANSI/TIA-606-B.....Administration Standard for Telecommunications Infrastructure (2012)

ANSI/TIA-606-A1.....Administration Standard for Telecommunications Infrastructure Addendum 1

TIA-607-B.....Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises (January 2013)

TIA-613.....High Speed Serial Interface for Data Terminal Equipment and Data Circuit Terminal Equipment (September 2005)

ANSI/TIA-758-B.....Customer-owned Outside Plant Telecommunications Infrastructure Standard (April 2012)

ANSI/TIA-854.....A Full Duplex Ethernet Specification for 1000 Mb/s (1000BASE-TX) Operating over Category 6 Balanced Twisted-Pair Cabling (2001)

ANSI/TIA-862-A.....Building Automation Systems Cabling Standard (April 2011)

TIA-942-A.....Telecommunications Infrastructure Standard for Data Centers (March 2014)

TIA-1152.....Requirements for Field Testing Instruments and Measurements for Balanced Twisted Pair Cabling (September 2009)

TIA-1179.....Healthcare Facility Telecommunications Infrastructure Standard (July 2010)

1.4 SINGULAR NUMBER

A. Where any device or part of equipment is referred in singular number (such as " rack"), reference applies to as many such devices as are required to complete installation.

1.5 RELATED WORK

A. Specification Order of Precedence: FAR Clause 52.236-21, VAAR Clause 852.236-71.

1. Field Cutting and Patching: Section 09 91 00, PAINTING.
2. Additional submittal requirements: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
3. Availability and source of references and standards specified in applicable publications: Section 01 42 19, REFERENCE STANDARDS.
4. Closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction: Section 07 84 00, FIRESTOPPING.
5. Sealant and caulking materials and their application: Section 07 92 00, JOINT SEALANTS.
6. General electrical requirements that are common to more than one section of Division 26: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
7. Electrical conductors and cables in electrical systems rated 600 V and below: Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).
8. Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
9. Conduit and boxes: Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
10. Wiring devices: Section 26 27 26, WIRING DEVICES.
11. General requirements common to more than one section in Division 28: Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.
12. Conductors and cables for electronic safety and security systems: Section 28 05 13, CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY.

13. Low impedance path to ground for electronic safety and security system ground fault currents: Section 28 05 26, GROUNDING AND BONDING FOR SECURITY SYSTEMS.
14. Conduits and partitioned telecommunications raceways for Electronic Safety and Security systems: Section 28 05 28.33, CONDUITS AND BACK BOXES FOR ELECTRONIC SAFETY AND SECURITY.
15. Video surveillance system cameras, data transmission wiring, and control stations with associated equipment: Section 28 23 00, VIDEO SURVEILLANCE EQUIPMENT AND SYSTEMS.

1.6 ADMINISTRATIVE REQUIREMENTS

A. Assign a single communications project manager to serve as point of contact for Government, contractor, and design professional.

B. Be proactive in scheduling work.
   1. Use of premises is restricted at times directed by COR.
   2. Movement of materials: Unload materials and equipment delivered to site.
   3. Coordinate installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
   4. Sequence, coordinate, and integrate installations of materials and equipment for efficient flow of Work.
   5. Coordinate connection of materials, equipment, and systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies; provide required connection for each service.
   6. Initiate and maintain discussion regarding schedule for ceiling construction and install cables to meet that schedule.

C. Contact the Office of Telecommunications, Special Communications Team (005OP2H3) (202)461-5310 to have a Government-accepted Telecommunications COR assigned to project for telecommunications review, equipment and system approval and coordination with other VA personnel.

D. Communications Project Manager Responsibilities:
   1. Assume responsibility for overall telecommunications system integration and coordination of work among trades, subcontractors, and authorized system installers.

2. Coordinate with related work indicated on drawings or specified.
3. Manage work related to telecommunications system installation in a manner approved by manufacturer.

1.7 SUBMITTALS

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

B. Provide parts list including quantity of spare parts.

C. Provide manufacturer product information. Government reserves the right to require a list of installations where products have been in operation.

D. Provide coordination drawings for all systems/equipment/devices, coordinate with all other trades, sections of corridor mechanical, plumbing, electrical, cable tray drawings shall be submitted for approval.

E. Provide Source Quality Control Submittal:
1. Submit written certification from OEM indicating that proposed supervisor of installation and proposed provider of warranty maintenance are authorized representatives of OEM. Include individual's legal name, contact information and OEM credentials in certification.
2. Submit written certification from OEM that wiring and connection diagrams meet Government Life Safety Guidelines, NFPA, NEC, NRTL, these specifications, and Joint Commission requirements and instructions, requirements, recommendations, and guidance set forth by OEM for the proper performance of system.
3. Pre-acceptance Certification: Certification in accordance with procedure outlined in Section 01 00 00, GENERAL REQUIREMENTS and specific Division 27 qualification documentation.

F. Installer Qualifications: Submit three installations of similar size and complexity furnished and installed by installer; include:
1. Installation location and name.
2. Owner’s name and contact information including, address, telephone and email.
3. Date of project start and date of final acceptance.
4. System project number.
5. Three-paragraph description of each system related to this project; include function, operation, and installation.

G. Provide delegated design submittals (e.g. seismic support design).

H. Submittals are required for all equipment anchors and supports. Include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion,) associated with equipment or conduit. Anchors and supports to resist seismic load based on seismic design categories per section 4.0 of VA seismic design requirements H-18-8 dated August, 2013.

I. Test Equipment List:

1. Supply test equipment of accuracy better than parameters to be tested.
2. Submit test equipment list including make and model number:
   a. ANSI/TIA-1152 CAT 6A class EA twisted pair cabling test instrument.
   b. Fiber optic insertion loss power meter with light source.
   c. Optical time domain reflectometer (OTDR).
   d. Volt-Ohm meter.
   e. Digital camera.
3. Supply only test equipment with a calibration tag from Government-accepted calibration service dated not more than 12 months prior to test.
4. Provide sample test and evaluation reports.

J. Submittal Drawings:

1. Telecommunications Space Plans/Elevations: Provide enlarged floor plans of telecommunication spaces indicating layout of equipment and devices, including receptacles and grounding provisions. Submit detailed plan views and elevations of telecommunication spaces showing racks, termination blocks, and cable paths. Include following rooms:
   a. Telecommunications rooms.
   b. Building Entrance Facility/Demarcation rooms.
   c. Server rooms/Data Center.
   d. Equipment rooms.
   e. Antenna Head End rooms.
2. Logical Drawings: Provide logical riser or schematic drawings for all systems.

a. Provide riser diagrams systems and interconnection drawings for equipment assemblies; show termination points and identify wiring connections.

3. Access Panel Schedule on Submittal Drawings: Coordinate and prepare a location, size, and function schedule of access panels required to fully service equipment.

K. Provide sustainable design submittals.

L. Furnish electronic certified test reports to COR prior to final inspection and not more than 90 days after completion of tests.

1.8 CLOSEOUT SUBMITTALS

A. Provide following closeout submittals prior to project closeout date:

1. Warranty certificate.
2. Evidence of compliance with requirements such as low voltage certificate of inspection.
3. Project record documents.
4. Instruction manuals and software that are a part of system.

B. Maintenance and Operation Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

1. Prepare a manual for each system and equipment specified.
2. Furnish on portable storage drive in PDF format or equivalent accepted by COR.
3. Furnish complete manual as specified in specification section, fifteen days prior to performance of systems or equipment test.
4. Furnish remaining manuals prior to final completion.
5. Identify storage drive "MAINTENANCE AND OPERATION MANUAL" and system name.
6. Include name, contact information and emergency service numbers of each subcontractor installing system or equipment and local representatives for system or equipment.
7. Provide a Table of Contents and assemble files to conform to Table of Contents.
8. Operation and Maintenance Data includes:
   a. Approved shop drawing for each item of equipment.
   b. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of equipment.
   c. A control sequence describing start-up, operation, and shutdown.
   d. Description of function of each principal item of equipment.

e. Installation and maintenance instructions.
f. Safety precautions.
g. Diagrams and illustrations.
h. Test Results and testing methods.
i. Performance data.
j. Pictorial "exploded" parts list with part numbers. Emphasis to be placed on use of special tools and instruments. Indicate sources of supply, recommended spare parts, and name of servicing organization.
k. Warranty documentation indicating end date and equipment protected under warranty.
l. Appendix; list qualified permanent servicing organizations for support of equipment, including addresses and certified personnel qualifications.

C. Record Wiring Diagrams:
1. Red Line Drawings: Keep one E size 91.44 cm x 121.92 cm (36 inches x 48 inches) set of floor plans, on site during work hours, showing installation progress marked and backbone cable labels noted. Make these drawings available for examination during construction meetings or field inspections.
2. General Drawing Specifications: Detail and elevation drawings to be D size 61 cm x 91.44 cm (24 inches x 36 inches) with a minimum scale of 0.635 cm = 30.48 cm (1/4 inch = 12 inches). ER, TR and other enlarged detail floor plan drawings to be D size 61 cm x 91.44 cm (24” x 36”) with a minimum scale of 0.635 cm = 30.48 cm (1/4 inch = 12 inches). Building composite floor plan drawings to be D size 61 cm x 91.44 cm (24 inches x 36 inches) with a minimum scale of 3.175 mm = 30.48 cm (1/8 inch = 1’ 0 inch).
3. Building Composite Floor Plans: Provide building floor plans showing work area outlet locations and configuration, types of jacks, distance for each cable, and cable routing locations.
4. Floor plans to include:
a. Final room numbers and actual backbone cabling and pathway locations and labeling.
b. Inputs and outputs of equipment identified according to labels installed on cables and equipment
c. Device locations with labels.

d. Conduit.

e. Head-end equipment.

f. Wiring diagram.

g. Labeling and administration documentation.

5. Submit Record Wiring Diagrams within five business days after final cable testing.
6. Deliver Record Wiring Diagrams as CAD files in .dwg or .dgn OR .rvt formats as determined by COR.
7. Deliver four complete sets of electronic record wiring diagrams to COR on portable storage drive.

D. Service Qualifications: Submit name and contact information of service organizations providing service to this installation within eight hours of receipt of notification service is needed.

1.9 MAINTENANCE MATERIAL SUBMITTALS

A. After approval and prior to installation, furnish COR with the following:
1. A 300 mm (12 inch) length of each type and size of wire and cable along with tag from coils of reels from which samples were taken.
2. One coupling, bushing and termination fitting for each type of conduit.
3. Samples of each hanger, clamp and supports for conduit and pathways.
4. Duct sealing compound.

1.10 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Manufacturer shall produce, as a principal product, the equipment and material specified for this project, and have manufactured item for at least three years.

B. Product and System Qualification:
1. OEM shall have three installations of equipment submitted presently in operation of similar size and type as this project, that have continuously operated for a minimum of three years.
2. Government reserves the right to require a list of installations where products have been in operation before approval.
3. Authorized representative of OEM shall be responsible for design, satisfactory operation of installed system, and certification.

C. Trade Contractor Qualifications: Trade contractor shall have completed three or more installations of similar systems of comparable size and complexity with regards to coordinating, engineering, testing,

certifying, supervising, training, and documentation. Identify these installations as a part of submittal.

D. System Supplier Qualifications: System supplier shall be authorized by OEM to warranty installed equipment.

E. Telecommunications technicians assigned to system shall be trained, and certified by OEM on installation and testing of system; provide written evidence of current OEM certifications for installers.

F. Manufactured Products:

1. Comply with FAR clause 52.236-5 for material and workmanship.
2. When more than one unit of same class of equipment is required, units shall be product of a single manufacturer.
3. Equipment Assemblies and Components:
   a. Components of an assembled unit need not be products of same manufacturer.
   b. Manufacturers of equipment assemblies, which include components made by others, to assume complete responsibility for final assembled unit.
   c. Provide compatible components for assembly and intended service.
   d. Constituent parts which are similar shall be a product of a single manufacturer.
4. Identify factory wiring on equipment being furnished and on wiring diagrams.

G. Testing Agencies: Government reserves the option of witnessing factory tests. Notify COR minimum 15 working days prior to manufacturer performing the factory tests.

1. When equipment fails to meet factory test and re-inspection is required, contractor is liable for additional expenses, including expenses of Government.

H. Contractor Qualification:

1. The Contractor or sub-contractor shall be a licensed Contractor with a minimum of three (3) years' experience installing and servicing systems of similar scope and complexity. 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 shall be 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 technicians shall have a minimum of five (5) continuous years of technical experience in cabling and terminations of low voltage equipment. 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 Contracting Officer of Record (COR) 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 shall 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.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
1. Government's approval of submittals shall be obtained for equipment and material before delivery to job site.
2. Deliver and store materials to job site in OEM's original unopened containers, clearly labeled with OEM's name and equipment catalog numbers, model and serial identification numbers for COR to inventory cable, patch panels, and related equipment.

B. Storage and Handling Requirements:
1. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:

a. Store and protect equipment in a manner that precludes damage or loss, including theft.
b. Protect painted surfaces with factory installed removable heavy kraft paper, sheet vinyl or equivalent.
c. Protect enclosures, equipment, controls, controllers, circuit protective devices, and other like items, against entry of foreign matter during installation; vacuum clean both inside and outside before testing and operating.

C. Coordinate storage.

1.12 FIELD CONDITIONS

A. Where variations from documents are requested in accordance with GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, connecting work and related components shall include additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

B. A contract adjustment or additional time shall not be granted because of field conditions pursuant to FAR 52.236-2 and FAR 52.236-3; a contract adjustment or additional time shall not be granted for additional work required for complete and usable construction and systems pursuant to FAR 52.246-12.

1.13 WARRANTY

A. Comply with FAR clause 52.246-21., except as follows:

1. Warranty material and equipment to be free from defects, workmanship, and remain so for a period of one year for Emergency Systems from date of final acceptance of system by Government; provide OEM’s equipment warranty document to COR.

   Government maintenance personnel shall have ability to contact OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time; contractor and OEM shall provide this capability.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Provide communications spaces and pathways conforming to TIA 569, at a minimum.

2.2 EQUIPMENT IDENTIFICATION

A. Provide laminated black phenolic resin, with a white core, nameplates with minimum 6 mm (1/4 inch) high engraved lettering.

B. Nameplates furnished by manufacturer as standard catalog items, unless other method of identification is indicated.

2.3 UNDERGROUND WARNING TAPE

A. Underground Warning: Standard 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type; red with black letters imprinted with "CAUTION BURIED ELECTRIC LINE BELOW", orange with black letters imprinted with "CAUTION BURIED TELEPHONE LINE BELOW" or orange with black letters imprinted with "CAUTION BURIED FIBER OPTIC LINE BELOW", as applicable.

2.4 WIRE LUBRICATING COMPOUND

A. Provide non-hardening or forming adhesive coating cable lubricants suitable for cable jacket material and raceway.

2.5 FIREPROOFING TAPE

A. Provide flexible, conformable fabric tape of organic composition and coated one side with flame-retardant elastomer.

B. Tape shall be self-extinguishing and cannot support combustion; arc-proof and fireproof.

C. Tape cannot deteriorate when subjected to water, gases, salt water, sewage, or fungus; and tape shall be resistant to sunlight and ultraviolet light.

D. Application shall withstand a 200-ampere arc for minimum 30 seconds.

E. Securing Tape: Glass cloth electrical tape minimum 0.18 mm (7 mils) thick and 19 mm (3/4 inch) wide.

2.6 UNDERGROUND CABLES

A. Provide buried closure suitable for enclosing a straight, butt, and branch splice in a container into which can be poured an encapsulating compound.

B. Provide closure of adequate strength to protect splice and maintain cable shield electrical continuity in buried environment.

C. Provide re-enterable encapsulating compound maintaining chemical stability of closure.

D. Provide filled splice cases in accordance with RUS Bull 345-72.

E. In Vault or Manhole:

1. Provide underground closure suitable to house a straight, butt, and branch splice in a protective housing into which can be poured an encapsulating compound
2. Closure shall be suitable thermoplastic, thermo-set, or stainless steel material supplying structural strength to pass mechanical and

electrical requirements in a vault or maintenance hole (manhole) environment.

F. Re-Enterable Encapsulating Compound: Product maintaining chemical stability of closure.

G. Provide gel-filled splice cases in accordance with RUS Bull 345-72.

PART 3 - EXECUTION

3.1 PREPARATION

A. Penetrations and Sleeves:

1. Lay out penetration and sleeve openings in advance, to permit provision in work.
2. Set sleeves in forms before concrete is poured.
3. Set sleeves prior to installation of structure for passage of pipes, conduit, ducts
4. Provide sleeves and packing materials at penetrations of foundations, walls, slabs, partitions, and floors.
5. Make sleeves that penetrate outside walls, basement slabs, footings, and beams waterproof.
6. Fill slots, sleeves and other openings in floors or walls if not used.
   a. Fill spaces in openings after installation of conduit or cable.
   b. Provide fill for floor penetrations to prevent passage of water, smoke, fire, and fumes.
   c. Provide fire resistant fill in rated floors and walls, to prevent passage of air, smoke and fumes.
7. Install sleeves through floors watertight and extend minimum 50.8 mm (2 inches) above floor surface.
8. Match and set sleeves flush with adjoining floor, ceiling, and wall finishes where raceways passing through openings are exposed in finished rooms.
9. Annular space between conduit and sleeve shall be minimum 6 mm (1/4 inch).
10. Do not provide sleeves for slabs-on-grade, unless specified or indicated otherwise.
11. Comply with requirements for firestopping, for sleeves through rated fire walls and smoke partitions.
12. Do not support piping risers or conduit on sleeves.

13. Identify unused sleeves and slots for future installation.
14. Provide core drilling if walls are poured or otherwise constructed without sleeves and wall penetration is required; do not penetrate structural members.

B. Core Drilling:
1. Avoid core drilling whenever possible.
2. Coordinate openings with other trades and utilities, to prevent damage to structural reinforcement.
3. Investigate existing conditions in vicinity of required opening prior to coring, including an x-ray of floor if determined necessary by competent person or COR.
4. Protect areas from damage.

C. Verification of In-Place Conditions:
1. Verify location, use and status of all material, equipment, and utilities that are specified, indicated, or determined necessary for removal.
   a. Verify materials, equipment, and utilities to be removed are inactive, not required, or in use after completion of project.
   b. Replace with equivalent any material, equipment and utilities that were removed by contractor that are required to be left in place.
2. Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under following conditions and then only after arranging to provide temporary utility services, according to requirements indicated:
   a. Notify COR in writing at least 14 days in advance of proposed utility interruptions.
   b. Do not proceed with utility interruptions without Government’s written permission.

D. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs for floor, wall and ceiling mounting of equipment as required.

E. Provide steel supports and hardware for installation of hangers, anchors, guides, and other support hardware.

F. Obtain and analyze catalog data, weights, and other pertinent data required for coordination of equipment support provisions and installation.

G. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly that would void warranty.

3.2 INSTALLATION - GENERAL

A. Coordinate systems, equipment, and materials installation with other building components.

B. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings.

C. Conform to VAAR 852.236.91 arrangements indicated, recognizing that work may be shown in diagrammatic form or have been impracticable to detail all items because of variances in manufacturers’ methods of achieving specified results.

D. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed in both exposed and un-exposed spaces.

E. Install equipment according to manufacturers' written instructions.

F. Install wiring and cabling between equipment and related devices.

G. Install cabling, wiring, and equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum interference of adjacent other installations.

H. Provide access panel or doors where units are concealed behind finished surfaces.

I. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for wiring, cabling, and equipment installations.

J. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide maximum headroom and access for service and maintenance as possible.

K. Install systems, materials, and equipment giving priority to systems required to be installed at a specified slope.

L. Avoid interference with structure and with work or other trades, preserving adequate headroom and clearing doors and passageways to satisfaction of COR and code requirements.

M. Install equipment and cabling to distribute equipment loads on building structural members provided for equipment support under other sections;

install and support roof-mounted equipment on structural steel or roof curbs as appropriate.

N. Provide supplementary or miscellaneous items, appurtenances, devices and materials for a complete installation.

3.3 EQUIPMENT INSTALLATION

A. Locate equipment as close as practical to locations shown on drawings.

B. Note locations of equipment requiring access on record drawings.

C. Access and Access Panels: Verify access panel locations and construction with COR.

D. Inaccessible Equipment:

1. Where Government determines that contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled as directed and without additional cost to Government.
2. Refer to Section 27 11 00, TELECOMMUNICATIONS ROOM FITTINGS for communication equipment cabinet assembly.
3. Refer to Section 27 11 00, TELECOMMUNICATIONS ROOM FITTINGS for equipment labeling.

3.4 EQUIPMENT IDENTIFICATION

A. Install an identification sign which clearly indicates information required for use and maintenance of equipment.

B. Secure identification signs with screws.

3.5 CUTTING AND PATCHING

A. Perform cutting and patching according to contract general requirements and as follows:

1. Remove samples of installed work as specified for testing.
2. Perform cutting, fitting, and patching of equipment and materials required to uncover existing infrastructure in order to provide access for correction of improperly installed existing or new work.
3. Remove and replace defective work.
4. Remove and replace non-conforming work.

B. Cut, remove, and legally dispose of selected equipment, components, and materials, including removal of material, equipment, devices, and other items indicated to be removed and items made obsolete by new work.

C. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.

D. Protect adjacent installations during cutting and patching operations.

E. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

F. Patch finished surfaces and building components using new materials specified for original installation and experienced installers.

3.6 FIELD QUALITY CONTROL

A. Provide work according to VAAR 852.236.91 and FAR clause 52.236-5.

B. Provide minimum clearances and work required for compliance with NFPA 70, National Electrical Code (NEC), and manufacturers' instructions; comply with additional requirements indicated for access and clearances.

C. Verify all field conditions and dimensions that affect selection and provision of materials and equipment, and provide any disassembly, reassembly, relocation, demolition, cutting and patching required to provide work specified or indicated, including relocation and reinstallation of existing wiring and equipment.

   1. Protect facility, equipment, and wiring from damage.

D. Submit written notice that:

   1. Project has been inspected for compliance with documents.
   2. Work has been completed in accordance with documents.

E. Non-Conforming Work: Conduct project acceptance inspections, final completion inspections, substantial completion inspections, and acceptance testing and demonstrations after verification of system operation and completeness by Contractor.

F. For project acceptance inspections, final completion inspections, substantial completion inspections, and testing/demonstrations that require more than one site visit by COR or design professional to verify project compliance for same material or equipment, Government reserves right to obtain compensation from contractor to defray cost of additional site visits that result from project construction or testing deficiencies and incompleteness, incorrect information, or non-compliance with project provisions.

   1. COR shall notify contractor, of hourly rates and travel expenses for additional site visits, and shall issue an invoice to Contractor for additional site visits.
   2. Contractor is not eligible for extensions of project schedule or additional charges resulting from additional site visits that result from project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions.

G. Tests:

1. Interim inspection is required at approximately 50 percent of installation.
2. Request inspection ten working days prior to interim inspection start date by notifying COR in writing; this inspection shall verify equipment and system being provided adheres to installation, mechanical and technical requirements of construction documents.
3. Inspection to be conducted by OEM and factory-certified contractor representative, and witnessed by COR, facility and SMCS 0050P2H3 representatives.
4. Check each item of installed equipment to ensure appropriate NRTL listing labels and markings are fixed in place.
5. Verify cabling terminations in DEMARC, MCR, TER, SCC, ECC, TRs and head end rooms, workstation locations and TCO adhere to color code for T568B pin assignments and cabling connections are in compliance with TIA standards.
6. Visually confirm minimum Category 6A cable marking at TCOs, CCSs locations, patch cords and origination locations.
7. Review entire communications circulating ground system, each TGB and grounding connection, grounding electrode and outside lightning protection system.
8. Review cable tray, conduit and path/wire way installation practice.
9. OEM and contractor to perform:
    a. Fiber optical cable field inspection tests via attenuation measurements on factory reels; provide results along with OEM certification for factory reel tests.
    b. Coaxial cable field inspection tests via attenuation measurements on factory reels; provide results along with OEM certification for factory reel tests.
    c. Baseband cable field inspection tests via attenuation measurements on factory reels and provide results along with OEM certification for factory reel tests.
10. Relocate failed cable reels to a secured location for inventory, as directed by COR, and then remove from project site within two working days; provide COR with written confirmation of defective cable reels removal from project site.
11. Provide results of interim inspections to COR.

12. If major or multiple deficiencies are discovered, additional interim inspections could be required until deficiencies are corrected, before permitting further system installation.
    a. Additional inspections are scheduled at direction of COR.
    b. Re-inspection of deficiencies noted during interim inspections, shall be part of system's Final Acceptance Proof of Performance Test.
    c. The interim inspection cannot affect the system's completion date unless directed by COR.
13. Facility COR shall ensure test documents become a part of system's official documentation package.

H. Pretesting: Re-align, re-balance, sweep, re-adjust and clean entire system and leave system working for a "break-in" period, upon completing installation of system and prior to Final Acceptance Proof of Performance Test. System RF transmitting equipment shall not be connected to keying or control lines during "break-in" period.
1. Pretesting Procedure:
    a. Verify systems are fully operational and meet performance requirements, utilizing accepted test equipment and spectrum analyzer.
    b. Pretest and verify system functions and performance requirements conform to construction documents and, that no unwanted physical, aural and electronic effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise are present.
2. Measure and record signal, aural and control carrier levels of each DAS RF, voice and data channel, at each of the following minimum points in system:
    a. Utility provider entrance.
    b. Buried conduit duct locations.
    c. Maintenance Holes (Manholes) and hand holes.
    d. ENTR or DEMARC.
    e. PBX interconnections.
    f. MCR interconnections.
    g. MCOR interconnections.
    h. TER interconnections.
    i. TOR interconnections.
    j. Control room interconnections.

k. TR interconnections.

l. System interfaces in locations listed herein.

m. HE interconnections.

n. Antenna (outside and inside) interconnections.

o. System and lightning ground interconnections.

p. Communications circulating ground system.

q. UPS areas.

r. Emergency generator interconnections.

s. Each general floor areas.

t. Others as required by AHJ (SMCS 005OP2H3).

3. Provide recorded system pretest measurements and certification that the system is ready for formal acceptance test to COR.

I. Acceptance Test:

1. Schedule an acceptance test date after system has been pretested, and pretest results and certification submitted to COR.
2. Give COR fifteen working days written notice prior to date test is expected to begin; include expected duration of time for test in notification.
3. Test in the presence of the following:

a. COR.

b. OEM representatives.

c. VACO:

1) CFM representative.

2) AHJ-SMCS 005OP2H3, (202)461-5310.

d. VISN-CIO, Network Officer and VISN representatives.

e. Facility:

1) FMS Service Chief, Bio-Medical Engineering and facility representatives.

2) OI&T Service Chief and OI&T representatives.

3) Safety Officer, Police Chief and facility safety representatives.

f. Local Community Safety Personnel:

1) Fire Marshal representative.

2) Disaster Coordinator representative.

3) EMS Representatives: Police, Sherriff, City, County or State representatives.

4. Test system utilizing accepted test equipment to certify proof of performance and Life and Public Safety compliance, FCC, NRTL, NFPA and OSHA compliance.
   a. Rate system as acceptable or unacceptable at conclusion of test; make only minor adjustments and connections required to show proof of performance.
      1) Demonstrate and verify that system complies with performance requirements under operating conditions.
      2) Failure of any part of system that precludes completion of system testing, and which cannot be repaired within four hours, terminates acceptance test of that portion of system.
      3) Repeated failures that result in a cumulative time of eight hours to affect repairs is cause for entire system to be declared unacceptable.
      4) If system is declared unacceptable, retesting shall be rescheduled at convenience of Government and costs borne by the contractor.

J. Acceptance Test Procedure:
1. Physical and Mechanical Inspection: The test team representatives shall tour major areas to determine system and sub-systems are completely and properly installed and are ready for acceptance testing.
2. A system inventory including available spare parts shall be taken at this time.
3. Each item of installed equipment shall be re-checked to ensure appropriate NRTL (i.e. UL) certification listing labels are affixed.
4. Confirm that deficiencies reported during Interim Inspections and Pretesting are corrected prior to start of Acceptance Test.
5. Inventory system diagrams, record drawings, equipment manuals, pretest results.
6. Failure of system to meet installation requirements of specifications is grounds for terminating testing and to schedule re-testing.

K. Operational Test:
1. Individual Item Test: VACO AHJ representative (SMCS 005OP2H3) may select individual items of DAS equipment for detailed proof of performance testing until 100 percent of system has been tested and found to meet requirements of the construction documents.

2. Government’s Condition of Acceptance of System Language:
   a. Without Acceptance: Until system fully meets conditions of construction documents, system’s ownership, use, operation and warranty commences at Government’s final acceptance date.
   b. With Conditional Acceptance: Stating conditions that need to be addressed by contractor or OEM and stating system’s use and operation to commence immediately while its warranty commences only at Government’s agreed final extended acceptance date.
   c. With Full Acceptance: Stating system’s ownership, use, operation and warranty to immediately commence at Government’s agreed to date of final acceptance.

L. Acceptance Test Conclusion: Reschedule testing on deficiencies and shortages with COR, after COR and SMCS AHJ jointly agree to result of the test, using the generated punch list or discrepancy list. Perform retesting to comply with these specifications at contractor's expense.

M. Proof of Performance Certification:
   1. If system is declared acceptable, AHJ (SMCS 005OP2H3) provides COR notice stating system processes to required operating standards and functions and is Government accepted for use by facility.
   2. Validate items with COR needing to be provided to complete project contract (i.e. charts & diagrams, manuals, spare parts, system warranty documents executed. Once items have been provided, COR contacts FMS service chief to turn over system from CFM oversight for beneficial use by facility.
   3. If system is declared unacceptable without conditions, rescheduled testing expenses shall be borne by contractor.

3.7 CLEANING

A. Remove debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from project site and clean work area, prior to final inspection and acceptance of work.

B. Put building and premises in neat and clean condition.

C. Remove debris on a daily basis.

D. Remove unused material, during progress of work.

E. Perform cleaning and washing required to provide acceptable appearance and operation of equipment to satisfaction of COR.

F. Clean exterior surface of all equipment, including concrete residue, dirt, and paint residue, after completion of project.

G. Perform final cleaning prior to project acceptance by COR.

H. Remove paint splatters and other spots, dirt, and debris; touch up scratches and mars of finish to match original finish.

I. Clean devices internally using methods and materials recommended by manufacturer.

J. Tighten wiring connectors, terminals, bus joints, and mountings, to include lugs, screws and bolts according to equipment manufacturer's published torque tightening values for equipment connectors. In absence of published connection or terminal torque values, comply with torque values specified in UL 486A-486B.

3.8 TRAINING

A. Provide training in accordance with subsection, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

B. Provide training for equipment or system as required in each associated specification.

C. Develop and submit training schedule for approval by COR, at least 30 days prior to planned training.

3.9 PROTECTION

A. Protection of Fireproofing:

1. Install clips, hangers, clamps, supports and other attachments to surfaces to be fireproofed, if possible, prior to start of spray fireproofing work.
2. Install conduits and other items that would interfere with proper application of fireproofing after completion of spray fire proofing work.
3. Patch and repair fireproofing damaged due to cutting or course of work shall be performed by installer of fireproofing and paid for by trade responsible for damage.

B. Maintain equipment and systems until final acceptance.

C. Ensure adequate protection of equipment and material during installation and shutdown and during delays pending final test of systems and equipment because of seasonal conditions.

3.10 COLOR CHART

A. All voice, video, and data cables and connectors to have the following colors:

Description Item	Jack	Cable	**Patch Cables**	I.D.	Notes
Telephone	Ivory	Ivory	Ivory	T	4 PR Cable
Data/Computer	Blue	Blue	Blue	C	4 PR Cable
Data/Computer	Yellow	Yellow	Yellow	C	4 PR Cable
Wireless Access point	Green	Green	Green	WAP	4 PR Cable
Fiber – Multi-mode	Black	Aqua	Aqua	FO	6/12/24/36
Fiber – Single-mode	Ivory	Yellow	Yellow	FO	6/12
TV	Blue Black	Blue Black	Blue Black	TV	4 PR Cable Coax
Sound System	-	Green		SS	Multi-conductors
CCTV – IP	White	White	White	CCTV	4 PR cable

---END---

---INTENTIONALLY BLANK---

SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section identifies common and general grounding and bonding requirements of communication installations and applies to all sections of Divisions 27 and 28 .

B. "Grounding electrode system" refers to all electrodes required by NEC, as well as including made, supplementary, telecommunications system grounding electrodes.

C. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.

1.2 RELATED WORK

A. Low voltage wiring: Section 27 10 00, CONTROL, COMMUNICATIONS & SIGNALING

1.3 SUBMITTALS

A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

B. Provide plan indicating location of system grounding electrode connections and routing of aboveground and underground grounding electrode conductors.

C. Closeout Submittals: In addition to Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS provide the following:

1. Certified test reports of ground resistance.
2. Certifications: Two weeks prior to final inspection, submit following to COR:
   a. Certification materials and installation is in accordance with construction documents.
   b. Certification complete installation has been installed and tested.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Grounding and Bonding Conductors:

1. Provide UL 83 insulated stranded copper equipment grounding conductors, with the exception of solid copper conductors for sizes 6 mm² (10 AWG) and smaller. Identify all grounding conductors with

continuous green insulation color, except identify wire sizes 25 mm² (4 AWG) and larger per NEC.

2. Provide ASTM B8 bare stranded copper bonding conductors, with the exception of ASTM B1 solid bare copper for wire sizes 6 mm² (10 AWG) and smaller.

B. Splices and Termination Components: Provide components meeting or exceeding UL 467 and clearly marked with manufacturer's name, catalog number, and permitted conductor sizes.

C. Telecommunication System Ground Busbars:

1. Telecommunications Main Grounding Busbar (TMGB):
   a. 6.4 mm (1/4 inch) thick solid copper bar.
   b. Minimum 100 mm (4 inches) high and length sized in accordance application requirements and future growth of minimum 510 mm (20 inches) long.
   c. Minimum thirty predrilled attachment points (two rows of fifteen each) for attaching standard sized two-hole grounding lugs.
      1) 27 lugs with 15.8 mm (5/8 inch) hole centers.
      2) 3 lugs with 25.4 mm (1 inch) hole centers.
   d. Wall-mount stand-off brackets, assembly screws and insulators for 100 mm (4 inches) standoff from wall.
   e. Listed as grounding and bonding equipment.
2. Telecommunications Grounding Busbar (TGB):
   a. 6.4 mm (1/4 inch) thick solid copper bar.
   b. Minimum 50 mm (2 inches) high and length sized in accordance application requirements and future growth of minimum 300 mm long (12 inches) long.
   c. Minimum nine predrilled attachment points (one row) for attaching standard sized two-hole grounding lugs.
      1) 6 lugs with 15.8 mm (5/8 inch) hole centers.
      2) 3 lugs with 25.4 mm (1 inch) hole centers.
   d. Wall-mount stand-off brackets, assembly screws and insulators for 100 mm (4 inches) standoff from wall.
   e. Listed as grounding and bonding equipment.

D. Equipment Rack and Cabinet Ground Bars:

1. Solid copper ground bars designed for horizontal mounting to framework of open racks or enclosed equipment cabinets:

a. 4.7 mm (3/16 inch) thick by 19.1 mm (3/4 inch) high hard-drawn electrolytic tough pitch 110 alloy copper bar.
b. 482 mm (19 inches) or 584 mm (23 inches) EIA/ECA-310-E rack mounting width (as required) for mounting on racks or cabinets.
c. Eight 6-32 tapped ground mounting holes on 25.4 mm (1 inch) intervals.
d. Four 7.1 mm (0.281 inch) holes for attachment of two-hole grounding lugs.
e. Copper splice bar of same material to transition between adjoining racks.
f. Two each 12-24 x 19.1 mm (3/4 inch) copper-plated steel screws and flat washers for attachment to rack or cabinet.
g. Listed as grounding and bonding equipment.

2. Solid copper ground bars designed for vertical mounting to framework of open racks or enclosed equipment cabinets:
   a. 1.3 mm (0.05 inch) thick by 17 mm (0.68 inch) wide tinned copper strip.
   b. 1997 mm (78 inches) high for mounting vertically on full height racks.
   c. Holes punched on 15.875 mm-15.875 mm-12.7 mm (5/8”-5/8”-1/2”) alternating vertical centers to match EIA/ECA-310-E Universal Hole Pattern for a 45 RMU rack.
   d. Three #12-24 zinc-plated thread forming hex washer head installation screws, an abrasive pad and antioxidant joint compound.
   e. NRTL listed as grounding and bonding equipment.

E. Ground Terminal Blocks: Provide screw lug-type terminal blocks at equipment mounting location (e.g. backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted.
1. Electroplated tin aluminum extrusion.
2. Accept conductors ranging from #14 AWG through 2/0.
3. Hold conductors in place by two stainless steel set screws.
4. Two 6 mm (1/4 inch) holes spaced on 15.8 mm (5/8 inch) centers to allow secure two-bolt attachment.
5. Listed as a wire connector.

F. Splice Case Ground Accessories: Provide splice case grounding and bonding accessories manufactured by splice case manufacturer when

available. Otherwise, use 16 mm² (6 AWG) insulated ground wire with shield bonding connectors.

G. Irreversible Compression Lugs:
   1. Electroplated tinned copper.
   2. Two holes spaced on 15.8 mm (5/8 inch) or 25.4 mm (1 inch) centers.
   3. Sized to fit the specific size conductor.
   4. Listed as wire connectors.

H. Antioxidant Joint Compound: Oxide inhibiting joint compound for copper-to-copper, aluminum-to-aluminum or aluminum-to-copper connections.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Exterior Equipment Grounding: Bond exterior metallic components (including masts and cabinets), antennas, satellite dishes, towers, raceways, primary telecommunications protector/arresters, secondary surge protection, waveguides, cable shields, down conductors and other conductive items to directly to Intersystem Bonding Termination.

B. Install telecommunications bonding backbone conductor throughout building via telecommunications backbone pathways effectively bonding all interior telecommunications grounding busbars in telecommunications rooms, Size telecommunications bonding backbone conductor as specified in TIA-607-B.

C. Inaccessible Grounding Connections: Utilize exothermic welding for bonding of buried or otherwise inaccessible connections with the exception of connections requiring periodic testing.

D. Conduit Systems:
   1. Bond ferrous metallic conduit to ground.
   2. Bond grounding conductors installed in ferrous metallic conduit at both ends of conduit using grounding bushing with #6 AWG conductor.

E. Boxes, Cabinets, and Enclosures:
   1. Bond each pull box, splice box, equipment cabinet, and other enclosures through which conductors pass (except for special grounding systems for intensive care units and other critical units shown) to ground.

F. Corrosion Inhibitors: Apply corrosion inhibitor for protecting connection between metals used to contact surfaces, when making ground and ground bonding connections.

G. Telecommunications Grounding System:

1. Bond telecommunications grounding systems and equipment to facility's electrical grounding electrode at Intersystem Bonding Termination.
2. Provide hardware as required to effectively bond metallic cable shields communications pathways, cable runway, and equipment chassis to ground.
3. Install bonding conductors without splices using shortest length of conductor possible to maintain clearances required by NEC.
4. Provide paths to ground that are permanent and continuous with a resistance of 1 ohm or less from each raceway, cable tray, and equipment connection to telecommunications grounding busbar.
5. Below-Grade Connections: When making exothermic welds, wire brush or file the point of contact to a bare metal surface. Use exothermic welding cartridges and molds in accordance with manufacturer's recommendations. After welds have been made and cooled, brush slag from weld area and thoroughly clean joint areas. Notify COR prior to backfilling at ground connections.
6. Above-Grade Bolted or Screwed Grounding Connections:
   a. Remove paint to expose entire contact surface by grinding.
   b. Clean all connector, plate and contact surfaces.
   c. Apply corrosion inhibitor to surfaces before joining.
7. Bonding Jumpers:
   a. Assemble bonding jumpers using insulated ground wire of size and type shown on drawings or use a minimum of 16 mm^2 (6 AWG) insulated copper wire terminated with compression connectors of proper size for conductors.
   b. Use connector manufacturer's compression tool.
8. Bonding Jumper Fasteners:
   a. Conduit: Connect bonding jumpers using lugs on grounding bushings or clamp pads on push-type conduit fasteners. Where appropriate, use zinc-plated external tooth lockwashers or Belleville Washers.
   b. Wireway and Cable Tray: Fasten bonding jumpers using zinc-plated bolts, external tooth lockwashers or Belleville washers and nuts. Install protective cover, e.g., zinc-plated acorn nuts, on bolts extending into wireway or cable tray to prevent cable damage.

c. Grounding Busbars: Fasten bonding conductors using two-hole compression lugs. Use 300 series stainless steel bolts, Belleville Washers, and nuts.

d. Slotted Channel Framing and Raised Floor Stringers: Fasten bonding jumpers using zinc-plated, self-drill screws and Belleville washers or external tooth lock washers.

H. Telecommunications Room Bonding:

1. Telecommunications Grounding Busbars:

a. Install busbar hardware no less than 950 mm (18 inches) A.F.F.on the telephone terminal board.

b. Where other grounding busbars are located in same room, e.g. electrical panelboard for telecommunications equipment, bond busbars together as indicated on grounding riser diagrams.

c. Make conductor connections with two-hole compression lugs sized to fit busbar and conductors.

d. Attach lugs with stainless steel hardware after preparing bond according to manufacturer recommendations and treating bonding surface on busbar with anti-oxidant to help prevent corrosion.

2. Telephone-Type Cable Rack Systems:

a. Aluminum pan installed on telephone-type cable rack serves as primary ground conductor within communications room.

b. Make ground connections by installing bonding jumpers:

1) Install minimum 16 mm^2 (6 AWG) bonding between telecommunications ground busbars and the aluminum pan installed on cable rack.

2) Install 16 mm^2 (6 AWG) bonding jumpers across aluminum pan junctions.

I. Self-Supporting and Cabinet-Mounted Equipment Rack Ground Bars:

1. Install rack-mount horizontal busbar or vertical busbar to provide multiple bonding points.

2. At each rack or cabinet containing active equipment or shielded cable terminations:

a. Bond busbar to ground as part of overall telecommunications bonding and grounding system.

b. Bond copper ground bars together using solid copper splice plates manufactured by same ground bar manufacturer, when ground bars

are provided at rear of lineup of bolted together equipment racks.

c. Bond non-adjacent ground bars on equipment racks and cabinets with 16 mm² (6 AWG) insulated copper wire bonding jumpers attached at each end with compression-type connectors and mounting bolts.

d. Provide 16 mm² (6 AWG) bonding jumpers between rack and cabinet ground busbars and overhead cable runway or raised floor stringers, as appropriate.

J. Backboards: Provide a screw lug-type terminal block or drilled and tapped copper strip near top of backboards used for communications cross-connect systems. Connect backboard ground terminals to cable runway using an insulated 16 mm² (6 AWG) bonding jumper.

K. Other Communication Room Ground Systems: Ground metallic conduit, wireways, and other metallic equipment located away from equipment racks or cabinets to cable tray or telecommunications ground busbar, whichever is closer, using insulated 16 mm² (6 AWG) ground wire bonding jumpers.

L. Communications Cable Grounding:

1. Bond all metallic cable sheaths in multi-pair communications cables together at each splicing or terminating location to provide 100 percent metallic sheath continuity throughout communications distribution system.

2. Install a cable shield bonding connector with a screw stud connection for ground wire, at terminal points. Bond cable shield connector to ground.

3. Bond all metallic cable shields together within splice closures using cable shield bonding connectors or splice case manufacturer’s splice case grounding and bonding accessories. When an external ground connection is provided as part of splice closure, connect to an effective ground source and bond all other metallic components and equipment at that location.

M. Communications Cable Tray Systems:

1. Bond metallic structures of cable tray to provide 100 percent electrical continuity throughout cable tray systems.

2. Where metallic cable tray systems are mechanically discontinuous:

a. Install splice plates provided by cable tray manufacturer between cable tray sections so resistance across a bolted connection is 0.010 ohms or less, as verified by measuring across splice plate connection.
b. Install 16 mm² (6 AWG) bonding jumpers across each cable tray splice or junction where splice plates cannot be used.

3. Bond cable tray installed in same room as telecommunications grounding busbar to busbar.

N. Communications Raceway Grounding:
1. Conduit: Use insulated 16 mm² (6 AWG) bonding jumpers to bond metallic conduit at both ends and intermediate metallic enclosures to ground.
2. Cable Tray Systems: Use insulated 16 mm² (6 AWG) grounding jumpers to bond cable tray to column-mounted building ground plates (pads) at both ends and approximately 16 meters (50 feet) on centers.

O. Ground Resistance:
1. Install telecommunications grounding system so resistance to grounding electrode system measures 5 ohms or less.
2. Measure grounding electrode system resistance using an earth test meter, clamp-on ground tester, or computer-based ground meter as defined in IEEE 81. Record ground resistance measurements before electrical distribution system is energized.
3. Backfill only after below-grade connection have been visually inspected by COR. Notify COR twenty-four hours before below-grade connections are ready for inspection.

3.2 LABELING

A. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
1. Label Text: "If this connector or cable is loose or if it shall be removed for any reason, notify the facility manager."
2. All ground Busses shall be labeled “Main Ground Bus”, “Telecom Room Ground Bus.”
3. All grounding cabling shall be labeled, “Ground Cable Bonded from Main TGB,” “Ground Cable Bonded from the Main Electrical Ground Bus” “Ground Cable Bonded from Electrical Panel XXX”, “Ground Cable Bonded to the Building Steel.”

3.3 FIELD QUALITY CONTROL

A. Perform tests per BICSI's Information Technology Systems Installation Methods Manual (ITSIMM), Recommended Testing Procedures and Criteria.

B. Perform two-point bond test using trained installers qualified to use test equipment.

C. Conduct continuity test to verify that metallic pathways in telecommunications spaces are bonded to TGB or TMGB.

D. Conduct electrical continuity test to verify that TMGB is effectively bonded to grounding electrode conductor.

E. Visually inspect to verify that screened and shielded cables are bonded to TGB or TMGB.

F. Perform a resistance test to ensure patch panel, rack and cabinet bonding connection resistance measures less than 5 Ohms to TGB or TMGB.

---END---

---INTENTIONALLY BLANK---

SECTION 27 05 33
RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies conduit, fittings, and boxes to form complete, coordinated, raceway systems. Raceways are required for communications cabling unless shown or specified otherwise.

1.2 RELATED WORK

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

B. Sealing around conduit penetrations through building envelope to prevent moisture migration into building: Section 07 92 00, JOINT SEALANTS.

C. Identification and painting of conduit and other devices: Section 09 91 00, PAINTING.

D. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

1.3 SUBMITTALS

A. Certification: Provide letter prior to final inspection, certifying material is in accordance with construction documents and properly installed.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Minimum Conduit Size: 32 mm (1 1/4 inch).

B. Conduit:

1. Rigid Galvanized Steel: Conform to UL 6, ANSI C80.1.
2. Rigid Intermediate Steel Conduit (IMC): Conform to UL 1242, ANSI C80.6.
3. Electrical Metallic Tubing (EMT):
   a. Maximum Size: 105 mm (4 inches).
   b. Install only for cable rated 600 volts or less.
   c. Conform to UL 797, ANSI C80.3.
4. Flexible Galvanized Steel Conduit: Conform to UL 1.
5. Liquid-tight Flexible Metal Conduit: Conform to UL 360.

6. Direct Burial Plastic Conduit: Conform to UL 651 and UL 651A, heavy wall PVC, or high-density polyethylene (HDPE).
7. Surface Metal Raceway: Conform to UL 5.
8. Wireway, approved “Basket”: Provide "Telecommunications Service” rated with approved length way partitions and cable straps to prevent wires and cables from changing from one partitioned pathway to another.

C. Conduit Fittings:

1. Rigid Galvanized Steel and Rigid Intermediate Steel Conduit Fittings:
   a. Provide fittings meeting requirements of UL 514B and ANSI/ NEMA FB 1.
   b. Sealing: Provide threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water and vapor. In concealed work, install sealing fittings in flush steel boxes with blank cover plates having same finishes as other electrical plates in room.
   c. Standard Threaded Couplings, Locknuts, Bushings, and Elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
   d. Locknuts: Bonding type with sharp edges for digging into metal wall of an enclosure.
   e. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into metallic body of fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
   f. Erickson (union-type) and Set Screw Type Couplings:
      1) Couplings listed for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete.
      2) Use set screws of case-hardened steel with hex head and cup point to seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
   g. Provide OEM approved fittings.
2. Electrical Metallic Tubing Fittings:
   a. Conform to UL 514B and ANSI/ NEMA FB1; only steel or malleable iron materials are acceptable.

b. Couplings and Connectors: Concrete tight and rain tight, with connectors having insulated throats.
   1) Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller.
   2) Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches).
   3) Use set screws of case-hardened steel with hex head and cup point to seat in wall of conduit for positive grounding.
c. Indent type connectors or couplings are not permitted.
d. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are not permitted.
e. Provide OEM approved fittings.

3. Flexible Steel Conduit Fittings:
   a. Conform to UL 514B; only steel or malleable iron materials are acceptable.
   b. Provide clamp type, with insulated throat.
   c. Provide OEM approved fittings.
4. Liquid-tight Flexible Metal Conduit Fittings:
   a. Conform to UL 514B and ANSI/ NEMA FB1; only steel or malleable iron materials are acceptable.
   b. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening.
   c. Provide connectors with insulated throats to prevent damage to cable jacket.
   d. Provide OEM approved fittings.
5. Direct Burial Plastic Conduit Fittings: Provide fittings meeting requirements of UL 514C and NEMA TC3, and as recommended by conduit manufacturer. Provide transition from PVC to IMC or Rigid conduit indoor above 3 inches of floor.
6. Surface Metal Raceway: Conform to UL 5 and “telecommunications service” rated with approved length-way partitions and cable straps to prevent wires and cables from changing from one partitioned pathway to another.
7. Surface Metal Raceway Fittings: As recommended by raceway manufacturer.
8. Expansion and Deflection Couplings:
   a. Conform to UL 467 and UL 514B.

b. Accommodate 19 mm (3/4 inch) deflection, expansion, or contraction in any direction, and allow 30-degree angular deflections.
c. Include internal flexible metal braid sized to ensure conduit ground continuity and fault currents in accordance with UL 467, and NEC code tables for ground conductors.
d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

9. Wireway Fittings: As recommended by wireway OEM.

D. Conduit Supports:
1. Parts and Hardware: Provide zinc-coat or equivalent corrosion protection.
2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
3. Multiple Conduit (Trapeze) Hangers: Minimum 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 2.78 mm (12 gage) steel, cold formed, lipped channels; with minimum 9 mm (3/8 inch) diameter steel hanger rods.
4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet, Splice, and Pull Boxes:
1. Conform to UL-50 and UL-514A.
2. Cast metal where required by NEC or shown and equipped with rustproof boxes.
3. Sheet Metal Boxes: Galvanized steel, except where otherwise shown.
4. Install flush mounted wall or ceiling boxes with raised covers so that front face of raised cover is flush with wall.
5. Install surface mounted wall or ceiling boxes with surface style flat or raised covers.
6. All communications outlets shall be 4-11/16 inch boxes with a minimum of 2-1/2-inch-deep with single or two gang 3/4 mud ring as shown on the drawings.

F. Wireways: Equip with hinged covers, except where removable covers are shown.

G. Warning Tape: Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type, red with black letters, and imprinted with "CAUTION BURIED COMMUNICATIONS CABLE BELOW".

H. Flexible Nonmetallic Communications Raceway (Innerduct) and Fittings:

1. General: Provide UL 910 listed plenum, riser, and general purpose corrugated pliable communications raceway for optical fiber cables and communications cable applications; select in accordance with provisions of NEC Articles 770 and 800.
2. Provide Communications Raceway with a factory installed 567 kg (1250 lb.) tensile pre-lubricated pull tape.
3. Use only metallic straps, hangers and fittings to support raceway from building structure. Cable ties are not permitted for securing raceway to building structure.
4. Provide fittings to be installed in spaces used for environmental air made of materials that do not exceed flammability, smoke generation, ignitibility, and toxicity requirements of environmental air space.
5. Size: Metric Designator 53 (trade size 2) or smaller.
6. Outside Plant: Plenum-rated where each interduct is 75 mm (3 inches) and larger.
7. Inside Plant: Listed and marked for installation in plenum airspaces and minimum 25 mm (1 inch) inside diameter.
8. Plenum: Non-metallic communications raceway.
   a. Constructed of low smoke emission, flame retardant PVC with corrugated construction.
   b. UL 94 V-O rating for flame spreading limitation.
9. Provide innerduct reel lengths as necessary to ensure ducts are continuous; one piece runs from ENTR to MH; MH to MH; DEMARC to MCR/TER; TR to TR. Innerduct connectors are not permitted between rooms.
10. Provide pulling accessories used for innerduct including but not limited to, inner duct lubricants, spreaders, applicators, grips, swivels, harnesses, and line missiles (blown air) compatible with materials being pulled.

I. Outlet Boxes:
   1. Flush wall mounted minimum 11.9 cm (4-11/16 inches) square, 9.2 cm (3-5/8 inches) deep pressed galvanized steel with single or double gang ¾ mud ring.
   2. Flush wall mounted 12.7 cm (5 inches) square x 7.3 cm (2-7/8 inches); deep pressed galvanized steel.
   3. 2-Gang Tile Box:
      a. Flush backbox type for installation in block walls.
      b. Minimum 92 mm (3-5/8 inches) deep.

J. Weatherproof Outlet Boxes: Surface mount two gang, 67 mm (2-5/8 inches) deep weatherproof cast aluminum with powder coated finish internal threads on hubs 19 mm (3/4 inch) minimum.
   1. Fittings: Field-formed, from straight sections, in accordance with manufacturer’s instructions.
   2. Provide accessories to protect, support and install wire basket tray system.

K. Cable Duct: Equip with hinged covers, except where removable covers are accepted by COR.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Raceways typically required for cabling systems unless otherwise indicated:

System	Specification Section	Installed Method
Grounding	27 05 26	Conduit Not Required
Control, Communication and Signal Wiring	27 10 00	Complete Conduit Allowed in Non-Partitioned Cable Tray or Cable Ladders
Communications Structured Cabling	27 15 00	Conduit to Cable Tray Partitioned Cable Tray
Grounding and Bonding for Electronic Safety and Security	28 05 26	Conduit Not Required Unless Required by Code
Video Surveillance	28 23 00	Complete Conduit

B. Penetrations:
   1. Cutting or Holes:

a. Locate holes in advance of installation. Where they are proposed in structural sections, obtain approval of structural engineer and COR prior to drilling through structural sections.

b. Make holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not permitted; COR may grant limited permission by request, in condition of limited working space.

c. Fire Stop: Where conduits, wireways, and other communications raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.

1) Fill and seal clearances between raceways and openings with fire stop material.

2) Install only retrofittable, non-hardening, and reusable firestop material that can be removed and reinstalled to seal around cables inside conduits.

d. Waterproofing at Floor, Exterior Wall, and Roof Conduit Penetrations:

1) Seal clearances around conduit and make watertight as specified in Section 07 92 00, JOINT SEALANTS or directed by waterproofing manufacturer.

C. Conduit Installation:

1. Minimum conduit size of 32 mm (1 1/4 inch), but not less than size required for 40 percent fill.
2. Install insulated bushings on all conduit ends.
3. Extend vertical conduits/sleeves through floors minimum 75 mm (3 inches) above floor and minimum 75 mm (3 inches) below ceiling of floor below.
4. Terminate conduit runs to and from a backboard in a closet or interstitial space at top or bottom of backboard. Install conduits to enter telecommunication rooms next to wall and flush with backboard.
5. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections.

6. Seal empty conduits located in telecommunications rooms or on backboards with a standard non-hardening putty compound to prevent entrance of moisture and gases and to meet fire resistance requirements.
7. Minimum radius of communication conduit bends:

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

8. Provide pull wire in all empty conduits; sleeves through floor are exceptions.
9. Complete each entire conduit run installation before pulling in cables.
10. Flattened, dented, or deformed conduit is not permitted.
11. Ensure conduit installation does not encroach into ceiling height head room, walkways, or doorways.
12. Cut conduit square with a hacksaw, ream, remove burrs, and draw tight.
13. Install conduit mechanically continuous and in straight run parallel with the corridor.
14. Install pull boxes after every 180 degrees of bends (two 90-degree bends). Size boxes per TIA 569. Support box with ¼ inch rod.
15. Independently support conduit at 2.44 m (8 feet) on center; do not use other supports (i.e., suspended ceilings, suspended ceiling supporting members, luminaires, conduits, mechanical piping, or mechanical ducts).
16. Support conduit within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.
17. Close ends of empty conduit with plugs or caps to prevent entry of debris, until cables are pulled in.
18. Conduit shall be supported within 150 mm (6 inches) of the cable tray.

19. Attach conduits to cabinets, splice cases, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on inside of enclosure, made up wrench tight. Do not make conduit connections to box covers.
20. Do not use aluminum conduits in wet locations.
21. Unless otherwise indicated on drawings or specified herein, conceal conduits within finished walls, floors and ceilings.
22. Conduit Bends:
    a. Make bends with standard conduit bending machines; observe minimum bend radius for cable type and outside diameter.
    b. Conduit hickey is permitted only for slight offsets, and for straightening stubbed conduits.
    c. Bending of conduits with a pipe tee or vise is not permitted.
23. Layout and Homeruns - Deviations: Make only where necessary to avoid interferences and only after drawings showing proposed deviations have been submitted and approved by COR.

D. Concealed Work Installation:

1. In Concrete:
    a. Conduit: Rigid steel or IMC.
    b. Align and run conduit in direct lines.
    c. Install conduit through concrete beams only when the following occurs:
    1) Where shown on structural drawings.
    2) As accepted by COR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
    d. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
    1) Conduit outside diameter larger than 1/3 of slab thickness is prohibited.
    2) Space between Conduits in Slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.
    3) Install conduits approximately in center of slab to ensure a minimum of 19 mm (3/4 inch) of concrete around conduits.
    e. Make couplings and connections watertight. Use thread compounds that are NRTL listed conductive type to ensure low

resistance ground continuity through conduits. Tightening set screws with pliers is not permitted.

E. Furred or Suspended Ceilings and in Walls:
   1. Rigid steel, IMC. Different type conduits mixed indiscriminately in same system is not permitted.
   2. Align and run conduit parallel or perpendicular to building lines.
   3. Tightening set screws with pliers is not permitted.

F. Exposed Work Installation:
   1. Unless otherwise indicated on drawings, exposed conduit is only permitted in telecommunications rooms.
      a. Provide rigid steel, IMC..
      b. Different type of conduits mixed indiscriminately in system is not permitted.
   2. Align and run conduit parallel or perpendicular to building lines.
   3. Install horizontal runs close to ceiling or beams and secure with conduit straps.
   4. Support horizontal or vertical runs at not over 2400 mm (96 inches) intervals.
   5. Surface Metal Raceways: Use only where shown on drawings.
   6. Painting:
      a. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
      b. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color.
      c. Provide labels where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.

G. Each Conduit shall be labeled (Stenciled every 20 feet) with the following information for each system as follows:
   1. Orange: Demarcation Point
   2. Green: Network Connection.
   3. Purple: Common equipment.
   4. White: First Level, Terminating building backbone, MC (CD) to IC (BD)
   5. Gray: Second level, IC(BD) to TR(HD)/FD)
   6. Blue: Horizontal Cabling.
   7. Brown: Campus Backbone.
   8. Yellow: Misc, security, PACS, CATV, MATV, Nurse call.

9. Red: Fire Alarm.

H. Expansion Joints:

1. Conduits 75 mm (3 inches) and larger, that are secured to building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install couplings in accordance with manufacturer's recommendations.
2. Provide conduits smaller than 75 mm (3 inches) with pull boxes on both sides of expansion joint. Connect conduits to expansion and deflection couplings as specified.
3. Install expansion and deflection couplings where shown.

I. Seismic Areas:

1. In seismic areas, follow H-18-8 Seismic Design Requirements.
2. Rigidly secure conduit to building structure on opposite sides of a building expansion joint with pull boxes on both sides of joint.
3. Connect conduits to pull boxes with 375 mm (15 inches) of slack flexible conduit.
4. Install green copper wire minimum #6 AWG in flexible conduit for bonding jumper.

J. Conduit Supports, Installation:

1. Select AC193 code listed mechanical anchors or fastening devices with safe working load not to exceed 1/4 of proof test load.
2. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.
3. Support multiple conduits runs with trapeze hangers. Use trapeze hangers designed to support a load equal or greater than sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other accepted fasteners.
4. Support conduit independent of pull boxes, luminaires, suspended ceiling components, angle supports, duct work, and similar items.
5. Fastenings and Supports in Solid Masonry and Concrete:
    a. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing concrete.
    b. Existing Construction:

1) Code AC193 listed wedge type steel expansion anchors minimum 6 mm (1/4 inch) bolt size and minimum 28 mm (1-1/8 inch) embedment.
2) Power set fasteners minimum 6 mm (1/4 inch) diameter with depth of penetration minimum 75 mm (3 inches).
3) Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.

6. Fastening to Hollow Masonry: Toggle bolts are permitted.
7. Fastening to Metal Structures: Use machine screw fasteners or other devices designed and accepted for application.
8. Bolts supported only by plaster or gypsum wallboard are not acceptable.
9. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
10. Do not support conduit from chain, wire, or perforated strap.
11. Spring steel type supports or fasteners are not permitted except horizontal and vertical supports/fasteners within walls.
12. Vertical Supports:
    a. Install riser clamps and supports for vertical conduit runs in accordance with NEC.
    b. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

K. Box Installation:

1. Boxes for Concealed Conduits:
    a. Flush mounted.
    b. Provide raised covers for boxes to suit wall or ceiling, construction and finish.
2. In addition to boxes shown, install additional boxes where needed to prevent damage to cables during pulling.
3. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
4. Stencil or install phenolic nameplates on covers of boxes identified on riser diagrams; for example "SIG-FA JB No. 1".

5. Outlet boxes mounted back-to-back in same wall are not permitted. A minimum 600 mm (24 inches) center-to-center lateral spacing must be maintained between boxes.

L. Flexible Nonmetallic Communications Raceway (Innerduct), Installation:

1. Install supports from building structure for horizontal runs at intervals not to exceed 900 mm (3 feet) and at each end.
2. Install supports from building structure for vertical runs at intervals not to exceed 1.2 m (4 feet) and at each side of joints.
3. Install only in accessible spaces not subject to physical damage or corrosive influences.
4. Make bends manually to assure internal diameter of tubing is not effectively reduced.
5. Extend each segment of innerduct minimum 300 mm (12 inches) beyond end of service conduit tie or cable tray. Restrain innerduct ends with wall mount clamps and seal when cable is installed.

3.2 EXISTING CONDUITS

A. Existing conduit can be used for new work.

B. If existing conduit is going to be used for new cables, the contractor shall clean the conduit from mud and dirt, pull all unused cables before the new cables are pulled/installed.

C. Contractor shall provide protection for the new cable while pulling it in the existing conduit.

D. Perform simple continuity test after cable installation.

3.3 TESTING

A. Examine fittings and locknuts for secureness.

B. Test RMC, IMC and EMT systems for electrical continuity.

C. Perform simple continuity test after cable installation.

- - - E N D - - -

---INTENTIONALLY BLANK---

SECTION 27 10 00
CONTROL, COMMUNICATION AND SIGNAL WIRING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes control, communication and signal wiring for a comprehensive systems infrastructure.

B. This section applies to all sections of Divisions 27 and 28.

1.2 RELATED WORK

A. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

B. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

C. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

1.3 SUBMITTALS

A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

B. Submit written certification from OEM:

1. Indicate wiring and connection diagrams meet National and Government Life Safety Guidelines, NFPA, NEC, NRTL, Joint Commission, OEM, this section and Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
2. Include instructions, requirements, recommendations, and guidance for proper performance of system as described herein.
3. Government shall not approve any submittal without this certification.

C. Identify environmental specifications on technical submittals; identify requirements for installation.

1. Minimum floor space and ceiling heights.
2. Minimum size of doors for cable reel passage.

D. Provide conduit size requirements.

E. Closeout Submittals:

1. Provide contact information for maintenance personnel to contact contractor for emergency maintenance and logistic assistance, and

assistance in resolving technical problems at any time during warranty period.

2. Provide certified OEM sweep test tags from each cable reel to COR.
3. Furnish spare or unused wire and cable with appropriate connectors (female types) for installation in appropriate punch blocks, barrier strips, patch, or bulkhead connector panels.
4. Turn over unused and opened installation kit boxes, coaxial, fiber optic, and twisted pair cable reels, conduit, cable tray, cable duct bundles, wire rolls, physical installation hardware to COR.
5. Documentation: Include any item or quantity of items, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to completely and correctly provide system documentation required herein.

PART 2 - PRODUCTS

2.1 CONTROL WIRING

A. Provide control wiring large enough so voltage drop under in-rush conditions does not adversely affect operation of controls.
B. Provide cable meeting specifications for type of cable.
C. Outside Location (i.e. above ground, underground in conduit, ducts, pathways. Provide cables filled with a waterproofing compound between outside jacket (not touching any provided armor) and inter conductors to seal punctures in jacket and protect conductors from moisture.
D. Remote Control Cable:
   1. Multi-conductor with stranded conductors able to handle power and voltage required to control specified system equipment, from a remote location.
   2. NRTL listed and pass VW-1 vertical wire flame test (UL 83) (formerly FR-1).
   3. Color-coded Conductors: Combined multi-conductor and coaxial cables are acceptable for this installation, on condition system performance standards are met.
   4. Technical Characteristics:
      a. Length: As required, in 1K (3,000 ft.) reels minimum.
      b. Connectors: As required by system design.
      c. Size:
         1) 18 AWG, minimum, Outside.

2) 20 AWG, minimum, Inside.

d. Color Coding: Required, EIA industry standard.

e. Bend Radius: 10 times cable outside diameter.

f. Impedance: As required.

g. Shield Coverage: As required by OEM specification.

h. Attenuation:

Frequency in MHz	dB per 305 Meter (1,000 feet), maximum
0.7	5.2
1.0	6.5
4.0	14.0
8.0	19.0
16.0	26.0
20.0	29.0
25.0	33.0
31.0	36.0
50.0	52.0

E. Distribution System Signal Wires and Cables:

1. Provide in same manner, and use construction practices, as Fire Protective and other Emergency Systems identified and defined in NFPA 101, Life Safety Code, Chapters 7, 12, and 13, NFPA 70, National Electrical Code, Chapter 7, Special Conditions.
2. Provide system able to withstand adverse environmental conditions without deterioration, in their respective location.
3. Provide entering of each equipment enclosure, console, cabinet or rack in such a manner that all doors or access panels can be opened and closed without removal or disruption of cables.
4. Terminate on an item of equipment by direct connection.

2.2 COMMUNICATION AND SIGNAL WIRING

A. Provide communications and signal wiring conforming to recommendations of manufacturers of systems; provide not less than TIA Performance Category 6.

B. Wiring shown is for typical systems; provide wiring as required for systems being provided.

C. Provide color-coded conductor insulation for multi-conductor cables.

D. Connectors:

1. Provide connectors for transmission lines, and signal extensions to maintain uninterrupted continuity, ensure effective connection, and preserve uniform polarity between all points in system.
   a. Provide AC barrier strips with a protective cover to prevent accidental contact with wires carrying live AC current.
   b. Provide punch blocks for signal connection, not AC power. AC power twist-on wire connectors are not permitted for signal wire terminations.
2. Cables: Provide connectors designed for specific size cable and conductors being installed with OEM's approved installation tool. Typical system cable connectors include:
   a. Audio spade lug.
   b. Punch block.
   c. Wirewrap.

2.3 INSTALLATION KIT

A. Include connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, cable tray required to accomplish a neat and secure installation.

B. Terminate conductors in a spade lug and barrier strip, wire wrap terminal or punch block, so there are no unfinished or unlabeled wire connections.

C. Minimum required installation sub-kits:
   1. System Grounding:
      a. Provide required cable and installation hardware for effective ground path, including the following:
         1) Control Cable Shields.
         2) Data Cable Shields.
         3) Equipment Racks.
         4) Equipment Cabinets.
         5) Conduits.
         6) Ducts.
         7) Cable Trays.
         8) Power Panels.
         9) Connector Panels.
         10) Grounding Blocks.

b. Bond radio equipment to earth ground via internal building wiring, according to NEC.

2. Wire and Cable: Provide connectors and terminals, punch blocks, tie wraps, hangers, clamps, labels, required to accomplish termination in an orderly installation.
3. Conduit, Cable Duct, and Cable Tray: Provide conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, cable tray installation in accordance with NEC and documents.
4. Equipment Interface: Provide any items or quantity of equipment, cable, mounting hardware and materials to interface systems with identified sub-systems, according to OEM requirements and construction documents.
5. Labels: Provide any item or quantity of labels, tools, stencils, and materials to label each subsystem according to OEM requirements, as-installed drawings, and construction documents.

D. Cross-Connection System (CCS) Equipment Breakout, Termination Connector (or Bulkhead), and Patch Panels:

1. Connector Panels: Flat smooth 3.175 mm (1/8 inch) thick solid aluminum, custom designed, fitted and installed in cabinet. Install bulkhead equipment connectors on panel to enable cabinet equipment’s signal, control, and coaxial cables to be connected through panel. Match panel color to cabinet installed.

a. Voice (or Telephone):

1) Provide industry standard Type 110 (minimum) punch blocks for voice or telephone, and control wiring instead of patch panels, each being certified for category 5e.
2) IDC punch blocks (with internal RJ45 jacks) are acceptable for use in CCS when designed for Category 5e, and the size and type of cable used.
3) Secure punch block strips to OEM designed physical anchoring unit on a wall location in TRS; console, cabinet, rail, panel, mounting is permitted at OEM recommendation and as accepted by COR. Punch blocks are not permitted for Class II or 120 VAC power wiring.
4) Technical Characteristics:

a) Number of Horizontal Rows: Minimum 100.
b) Number of Terminals per Row: Minimum 4.
c) Terminal Protector: Required for each used or unused terminal.
d) Insulation Splicing: Required between each row of terminals.

b. Digital or High Speed Data:
1) Provide 480 mm (19 inches) horizontal EIA/ECA 310 rack mountable patch panel with EIA/ECA 310 standard spaced vertical mounting holes for digital or high-speed data service CSS, with modular female Category 5E (or on a case by case basis Category 6A for specialized powered systems accepted by SMCS 005OP2H3, (202) 461-5310, OI&T and FMS Services, and COR) RJ45 jacks designed for size and type of UTP or F/UTP cable installed in rows.
2) Technical Characteristics:
a) Number of Horizontal Rows: Minimum 2.
b) Number of Jacks Per Row: Minimum 24.
c) Type of Jacks: RJ45.
d) Terminal Protector: Required for each used or unused jack.
e) Insulation: Required between each row of jacks.

2.4 EXISTING WIRING

A. Reuse existing wiring only where indicated on plans and accepted by SMCS 005OP2H3.
B. Only existing wiring that conforms to specifications and applicable codes can be reused; existing wiring that does not meet these requirements cannot be reused and must be removed by contractor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Install wiring in cable tray or raceway.
2. Seal cable entering a building from underground, between wire and conduit where cable exits conduit, with non-hardening approved compound.
3. Wire Pulling:

a. Provide installation equipment that prevents cutting or abrasion of insulation during pulling of cables.
b. Use ropes made of nonmetallic material for pulling feeders.
c. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached to conductors, as accepted by COR.
d. Pull multiple cables into a single conduit together.

B. Installation in Maintenance or Man holes:
1. Install and support cables in maintenance holes on steel racks with porcelain or equal insulators.
2. Train cables around maintenance hole walls, but do not bend to a radius less than six times overall cable diameter.
3. Fireproofing:
a. Install fireproofing where low voltage cables are installed in same maintenance holes with high voltage cables; also cover low voltage cables with arc proof and fireproof tape.
b. Use tape of same type used for high voltage cables, and apply tape in a single layer, one-half lapped or as recommended by manufacturer. Install tape with coated side towards the cable and extend minimum 25 mm (1 inch) into each duct.
c. Secure tape in place by a random wrap of glass cloth tape.

C. Control, Communication and Signal Wiring Installation:
1. Unless otherwise specified in other sections, provide wiring and connect to equipment/devices to perform required functions as indicated.
2. Install separate cables for each system so that malfunctions in any system does not affect other systems, except where otherwise required.
3. Group wires and cables according to service (i.e. AC, grounds, signal, DC, and control.) DC, control and signal cables can be included with any group.
4. Form wires and cables to not change position in group throughout the conduit run. Bundle wires and cables in accepted signal duct, conduit, cable ducts, or cable trays neatly formed, tied off in 600 mm to 900 mm (24 inch to 36 inch) lengths to not change position in group throughout run.
5. Concealed splices are not allowed.

6. Separate, organize, bundle, and route wires or cables to restrict EMI, channel crosstalk, or feedback oscillation inside any enclosure.
7. Looking at any enclosure from the rear (wall mounted enclosures, junction, pull or interface boxes from the front), locate AC power, DC and speaker wires or cables on the left; coaxial, control, microphone and line level audio and data wires or cables, on the right.
8. Provide ties and fasteners that do not damage or distort wires or cables. Limit spacing between tied points to maximum 150 mm (6 inches).
9. Install wires or cables outside of buildings in conduit, secured to solid building structures.
10. Wires or cables must be specifically accepted, on a case by case basis, to be installed outside of conduit. Bundled wires or cables shall be tied at minimum 460 mm (18 inches) intervals to a solid building structure; bundled wires or cables shall have ultra violet protection and be waterproof (including all connections).
11. Laying wires or cables directly on roof tops, ladders, drooping down walls, walkways, floors is not permitted.
12. Wires or cables installed outside of conduit, cable trays, wireways, cable duct.
    a. Only when authorized, can wires or cables be identified and approved to be installed outside of conduit.
    b. Provide wire or cable rated plenum and OEM certified for use in air plenums.
    c. Provide wires and cables hidden, protected, fastened and tied at maximum 600 mm (24 inches) intervals, to building structure.
    d. Provide closer wire or cable fastening intervals to prevent sagging, maintain clearance above suspended ceilings.
    e. Remove unsightly wiring and cabling from view, and discourage tampering and vandalism.
    f. Sleeve and seal wire or cable runs, not installed in conduit, that penetrate outside building walls, supporting walls, and two hour fire barriers, with an approved fire retardant sealant.

D. AC Power:

1. Bond to ground contractor-installed equipment and identified Government-furnished equipment, to eliminate shock hazards and to minimize ground loops, common mode returns, noise pickup, and crosstalk for total ground resistance of 0.1 Ohm or less.
2. Use of conduit, signal duct or cable trays as system or electrical ground is not permitted; use these items only for dissipation of internally generated static charges (not to be confused with externally generated lightning) that can be applied or generated outside mechanical and physical confines of system to earth ground. Discovery of improper system grounding is grounds to declare system unacceptable and termination of all system acceptance testing.
3. Cabinet Bus: Extend a common ground bus of at least #10 AWG solid copper wire throughout each equipment cabinet and bond to system ground. Provide a separate isolated ground connection from each equipment cabinet ground bus to system ground. Do not tie equipment ground busses together.
4. Equipment: Bond equipment to cabinet bus with copper braid equivalent to at least #12 AWG. Self-grounding equipment enclosures, racks or cabinets, that provide OEM certified functional ground connections through physical contact with installed equipment, are acceptable alternatives.

3.2 EQUIPMENT IDENTIFICATION

A. Control, Communication and Signal System Identification:
   1. Install a permanent wire marker on each wire at each termination.
   2. Identify cables with numbers and letters on the labels corresponding to those on wiring diagrams used for installing systems.
   3. Install labels retaining their markings after cleaning.
   4. In each maintenance hole (manhole) and handhole, install embossed brass tags to identify system served and function.

B. Labeling:
   1. Industry Standard: ANSI/TIA-606-B.
   2. Print lettering for voice and data circuits using laser/jet printers
   3. Cable and Wires (hereinafter referred to as “cable”): Label cables at both ends in accordance with industry standard. Provide permanent labels in contrasting colors. Identify cables matching system Record Wiring Diagrams.

4. Equipment: Permanently labeled system equipment with contrasting plastic laminate or bakelite material. Label system equipment on face of unit corresponding to its source.
5. Conduit, Cable Duct, and Cable Tray: Label conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 meters (10 ft.) identifying system. Label each enclosure according to this standard.
6. Termination Hardware: Label workstation outlets and patch panel connections using color coded labels with identifiers in accordance with industry standard and Record Wiring Diagrams.

3.3 TESTING

A. Minimum test requirements are for impedance compliance, inductance, capacitance, signal level compliance, opens, shorts, cross talk, noise, and distortion, and split pairs on cables in frequency ranges specified.
B. Tests required for data cable must be made to confirm operation of this cable at minimum 10 Mega (M) Hertz (Hz) full bandwidth, fully channel loaded and a Bit Error Rate of a minimum of 10-6 at maximum rate of speed.
C. Provide cable installation and test records at acceptance testing to COR and thereafter maintain in facility’s telephone switch room.
D. Record changes (used pair, failed pair) in these records as change occurs.
E. Test cables after installation and replace any defective cables.

---END---

SECTION 27 11 00
TELECOMMUNICATIONS ROOM FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies equipment cabinets, interface enclosures, relay racks, patch panels, patch cords, fiber and copper, wire management, vertical and horizontal, grounding and bonding and associated hardware in service provider DEMARC, computer and telecommunications rooms.

1.2 RELATED WORK

A. Wiring devices: Section 26 27 26, WIRING DEVICES.

B. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

C. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

D. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

E. Low voltage cabling system infrastructure: Section 27 10 00, CONTROL, COMMUNICATION AND SIGNAL WIRING.

1.3 SUBMITTALS

A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATION.

B. Separate submittal into sections for each subsystem containing the following:

1. Pictorial layouts of each Telecommunications Room and Cross Connection Space (VCCS, and HCCS termination cabinets), each distribution cabinet layout, and TCO as each is expected to be installed and configured.
2. Equipment technical literature detailing electrical and technical characteristics of each item of equipment to be furnished.

C. Environmental Requirements: Identify environmental specifications for housing system as initial and expanded system configurations.

1. Floor loading for batteries and cabinets.
2. Minimum floor space and ceiling height.
3. Minimum door size for equipment passage.

1.4 WARRANTY

A. Work subject to term of Article "Warranty of Construction" FAR Clause 52.246.21.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Provide components of cabinet system (cabinet, thermal, cable and power management accessories) from a single manufacturer.

B. Equipment Standards and Testing:

1. Equipment shall be listed by a NRTL where a UL standard is in existence; active and passive equipment shall conform to each UL standard in effect for equipment, on the submittal date.
2. Each item of electronic equipment shall be labeled by a NRTL that warrants equipment has been tested in accordance with, and conforms to specified standards.

C. Equipment Cabinets (Enclosures):

1. Fully enclose and physically secure internally mounted and connected, active and passive equipment.
2. Types of Equipment Enclosures accepted for specific VA Spectrum Management, FMS and OI&T applications in CFM and Facility Projects:

CABINET	FUNCTION
Communications	FMS Special Communications Equipment
Server / Router	OI&T Data/LAN/WAN Equipment
Seismic	Either FMS or OI&T use, specify need
Environmental	Either FMS or OI&T use, specify need

3. Each cabinet to be:
   a. Provided in head end, MCR, TER, PCR, EMGR, each TR and two cabinets at a minimum.
   b. Fabricated with minimum 1.59 mm (16 gauge) steel.
   c. Provided with manufacturer's standard painted finish in a color accepted by COR with concurrence from FMS Service Chief.
   d. Mounted on floor or wall.
   e. Lockable; tubular locks keyed alike. Provide six keys to COR for each cabinet.
4. Provide equipment mounting shelves; attach to front and rear mounting rails and allowing equipment to be secured to respective mounting rails.

5. Each enclosure to include:
   a. Floor or wall mounting.
   b. Knock out holes for conduit connections or cable entrance.
   c. Front and rear locking doors; wall mounted cabinets require only front locking door.
   d. Power outlet strips.
6. Provide quiet ventilation fan with non-disposable locally cleanable air filter.
7. Size each cabinet in order to contain and maintain internal mounted equipment items.
8. Provide OEM’s fully assembled unit.
9. Provide OEM assembled side-by-side enclosures in a single unit, at locations requiring more than two enclosures.
10. Provide minimum one cabinet with blank rack space, for additional system expansion equipment.
11. Bond to communications circulating grounding system.
12. Technical Characteristics:
    a. External:
       1) Overall Height:
          a) Communications/Server: Maximum 2,184 mm (86 inches).
          b) Seismic: Maximum 1,905 mm (75 inches).
       2) Overall Depth:
          a) Communications/Server: Maximum 914 mm (36 inches).
          b) Seismic: Maximum 762 mm (30 inches).
       3) Overall Width - All: Maximum 864 mm (34 inches).
    b. Front Panel Openings:
       1) Width:
          a) Communications: 584 mm (23 inches), per EIA. 310.
          b) Server: 762 mm (30 inches), per EIA/ECA 310.
          c) Seismic: 483 mm (19 inches), per EIA/ECA 310.
       2) Height:
          a) Communications/Server: Maximum 2,000 mm (78-3/4 inches or 45 Rack Units [RU]), per EIA/ECA 310.
          b) Seismic: Maximum 1,689 mm (66-1/2 inches or 38 RUs, per EIA/ECA 310).
    c. Heavy Duty Cycle: Maximum 544 kilograms (1,200 pounds) capacity.
    d. Certification:

1) NRTL (i.e. UL): For communications and server cabinets.
2) Telcordia Technologies: #63-GR-CORE, (2012) for seismic cabinets.
3) Seismic: Provide cabinet OEM constructed to seismic design category.

13. Cabinet Internal Components:
    a. AC Power:
        1) Standard "Quad AC Box":
            a) Power capacity: 20 Ampere, single phase, 120 VAC continuous duty.
            b) Wire gauge: #12 AWG, solid copper, connected to room's internal AC Power Panel, or as directed by COR.
            c) Number of AC power outlets: Minimum 4-20 A receptacles.
            d) Enclosure: Fully self-contained, metal 102 mm (4 inch) x 102 mm (4 inches) x 64 mm (2-1/2 inches) with cover
            e) Connection: Minimum 25.4 mm (1 inch) conduit connected to room's AC Power Panel, or as directed by COR
            f) Number of boxes: One.
            g) Compliance: NRTL (i.e. UL); NPFA - 70 (NEC).
    b. AC Power Line Surge Protector and Filter Construction:
        1) Input Voltage Range: 120 VAC + 15 percent at 50/60 Hz, single phase.
        2) Power Service Capacity: 20 AMP, 120 VAC.
        3) Voltage Output Regulation: +5.0 percent, instantaneous of input.
        4) Circuit Breaker: 15 AMP; shall be self-contained.
        5) AC Outlets: Minimum four duplex grounded NEMA 5-20R.
        6) Response Time: 5.0 nano-second.
        7) Suppression: Isolate and filter any noise, surge spikes
            a) Surge: Minimum 20,000 AMP.
            b) Noise:
                1) Common: -40 dB.
                2) Differential: -45 dB.
        8) Clamping Voltage: Minimum 300 V.
        9) Enclosure: One; self-contained.
        10) Mounting: Internal to cabinet floor or on internal mounting rail shelf, allowing two plugs from two plug strips.

11) AC Power Cord: Required; minimum 1,628 mm (6 feet), three wire (green ground); minimum #14 AWG stranded.

12) Compliance: NRTL (i.e. UL60950-1).

c. Uninterruptible Power Supply (UPS): Provide each cabinet with an internal UPS which shall be combined with surge protector and filter if system's 50 percent expansion requirement is met. Provide at least one hour continuous full load two hours if working with an emergency safety police system uninterruptible system primary AC Power, with a 50 percent reserve capacity, in the event of facility primary or emergency AC power failure.

1) UPS to include:

a) On-Off Switch: This function is required to be a part of system's electronic supervision requirements.

b) First/Fast Charge Unit: Shall provide clean predicable charge voltage/current. Function is required to be a part of system's electronic supervision requirements.

c) Over Voltage/Current Protect: Cannot short circuit AC power line at any time. This function is required to be a part of system's electronic supervision requirements.

d) Trickle Charge Unit: Shall be capable of maintaining a suitable internal battery charge without damaging batteries.

e) Mounting: Provide per OEM's direction.

f) Proper Ventilation: Do not override cabinets' ventilation system.

g) Power Change from AC Input: Accomplish change without interruption to communications link or subsystem being protected. Generate visual and aural alarms in electrical supervision system, local and remote, to annunciating panels via direct connection for trouble indication.

2) Specific requirements for current and surge protection to include:

a) Voltage Protection: Threshold, line to neutral, starts at maximum 200 Volts peak. Transient voltage cannot exceed 330 Volts peak. Furnish documentation on peak clamping Voltage as a function of transient waveform.

b) Peak Power Dissipation: Minimum 35 Joules per phase, as measured for 1.0 millisecond at sub branch panels, 100 Joules per phase at branch panels and 300 Joules per phase at service entrance panels. Typically, power dissipation is 12,000 Watts (W) for 1.0 mS (or 12 Joules). Provide explanation of how ratings were measured or empirically derived.

c) Surge Protector (shall be combined with On-Off switch of UPS): Shall not short circuit AC power line at any time.

1) Components shall be minimum silicon semi-conductors.

2) Secondary stages, if used, shall include other types of rugged devices.

3) Indicators: Provide visual device indicating surge suppression component is functioning.

4) Electrical Supervision: Required; shall be audile and visual, local and remote to annunciating panels via direct connection for trouble indication.

d) Provide current and surge protection on ancillary equipment.

e) Equip each cabinet with the following:

1) Equipment Mounting Rails (Front & Rear): Fully adjustable internal equipment mounting rails allowing front or rear equipment mounting with pre-drilled EIA/ECA 310-E Standard tapped holes. Support entire equipment by supplementary support in addition to face mounting screws on rails.

2) Cabinet Ground: Stainless steel adjustable, lug connected to cabinet’s main structure providing an internal cabinet ground for all installed equipment properly bolted to rail and with ground wire connected.

3) Grounding Terminals: A separate mounting hole on equipment mounting rail, with stainless steel connecting bolt bonded by minimum #10 AWG copper wire to cabinet’s internal grounding lug.

14. Ground Interconnection: Bond cabinet’s common grounding lug to room’s communications circulating ground busbar with a minimum #4 AWG stranded copper wire.

15. Blank Panels: Provide at every unused rack space.
    a. Match cabinet color.
    b. Provide panels of 3 mm (1/8 inch) thick aluminum with vertical dimensions in increments of one rack unit (RMU) or 45 mm (1-3/4 inch) with mounting holes spaced to correspond to EIA/ECA 310-E Standard 483 mm (19 inch) rack dimensions.
    c. Fill large unused openings with single standard large panel instead of numerous types.
    d. Leave one blank rack space (RMU), covered with a blank panel, between each item of equipment, for minimum internal air flow.
    e. Leave 356 mm (14 inches)(8.0 RMU) open space, covered with blank cover panel, for additional expansion equipment.
    f. Wire Management: System that connects each item of installed equipment to room wire management system.
    g. Knock-out Holes: Provide for cable entrance/exits via conduits, cable duct/trays.

D. Environmental Cabinet:
1. Enclosure shall fully contain installed equipment, including electronics, in same manner as standard cabinet. Provide climate control for installed equipment as if they were in a standalone air handling area, regardless of local area air handling capabilities.
2. Provide an OEM’s fully assembled unit enclosure.
3. If more than two enclosures are required in any system location, provide OEM-assembled enclosures, in a single unit, side-by-side.
4. Technical Characteristics:
    a. Environmental Control: Automatic, heating and cooling as required.
    b. Temperature Conditions (rated at 1,300 W of install equipment heat generation):
        1) Internal Range: Maintains 26.67 degree to 37.78 degree C (80 degree to 100 degree f) of internal heat conditions.
        2) External Range: Maximum 37.78 degrees + -3.89 degrees C (100 degrees + 25 degrees F).
    c. Forced Air Unit: Required with non-disposable air filter; unobstructed and uninterruptible.
    d. Air Conditioning: As required; fully internal mounted.
    e. Heater: As required; fully internal mounted.

f. UPS: Required; fully internal mounted.

g. Front Door: Full length, see through, EMI resistant and lockable, keyed alike with 7-pin tubular lock and Police Service SMS card access.

h. Rear door: Full length, see through, EMI resistant, and lockable keyed alike with 7-pin tubular lock and Police Service SMS card access.

i. Conduit Wiring Entrance: Top or bottom; fully sealed.

j. Input Power: Minimum 2 each; maximum 120 VAC at 20A, independent circuit, conduit for fixed or armored cable for moveable installations.

k. Dimensions:

1) Height: Maximum 1980 mm (78 inches).

2) Width: Maximum 635 mm (25 inches).

3) Depth: Maximum 965 mm (38 inches).

4) Front Panel Opening: 480 mm (19 inches), w/ EIA/ECA 310 mounting hole spacing.

l. Trouble Annunciator Panel: Refer to specific requirements in equipment cabinet.

m. Audio Monitor Panel: Refer to specific requirements in equipment cabinet.

E. Wall Mounted Distribution or System Interface Cabinet:

1. Construct of minimum 1.59 mm (16 gauge) cold rolled steel, with top, side and bottom panels.

2. Provide double-hinged front door and main cabinet body allowing access to all internal equipment and wiring; mount to solid walls or internal studs.

3. Provide baked-on iron phosphate primer and baked enamel paint finish in a color to be selected by the using FMS Chief or COR.

4. Provide integral and adjustable EIA/ECA 310 standard predrilled rack mounting rails to allow front panel equipment mounting and access.

5. After equipment, doors and panels are installed, snap-in-place chrome trim strip covers all front panel screw fasteners.

6. Provide full-length vertical piano hinge to allow entire front portion of cabinet to “swing out” from wall for access to installed equipment, wires and cable; maintain minimum OSHA Safety clearances and NFPA operational functions.

7. Provide an OEM’s fully assembled unit enclosure.
8. Equip these cabinets same as equipment cabinets, except mount UPS on floor below cabinet with AC power connection in conduit to AC service panel.
9. Technical Characteristics:
   a. Overall Height: Maximum 1,218 mm (48 inches).
   b. Overall Depth: Maximum 558 mm (22 inches).
   c. Overall Width: Maximum 610 mm (24 inches).
   d. Front Panel Horizontal: Maximum width 483 mm (19 inches).
   e. Capacity: Maximum 180 kilograms (400 pounds).
   f. Lockable:
      1) Tubular lock with 7-pin security.
         Key cabinets alike.

F. Stand Alone Open two (2) post or four (4) Equipment Rack:
1. Construct of minimum 1.59 mm (16 gauge) cold rolled steel with manufacturer's standard paint finish, in a color to be selected by COR with concurrence from facility’s FMS Service Chief.
2. Floor-mount as directed by COR with concurrence from facility’s FMS Service Chief.
3. Equip rack same as equipment cabinet, except mount UPS with additional support for weight and AC power connection in conduit to AC service panel.
4. Provide an OEM fully assembled unit.
5. Technical Characteristics:
   a. Overall Height: Maximum 2,180 mm (85-7/8 inches).
   b. Overall Depth: Maximum 650 mm (25-1/2 inches).
   c. Overall Width: Maximum 535 mm (21-1/16 inches).
   d. Front Panel Opening: 483 mm (19 inches), EIA/ECA 310 horizontal width.
   e. Hole Spacing: Per EIA/ECA 310.
   f. Load Capacity: Maximum 680.4 kg (1,500 lbs).
   g. Certifications:
      1) EIA/ECA: 310-E.
      2) NRTL (i.e. UL): OEM specific.
   h. AC Power:
      1) Standard “Quad AC Box”:

a) Power capacity: 20 Ampere, single phase, 120 VAC continuous duty.
b) Wire gauge: #12 AWG, solid copper, connected to room's internal AC Power Panel, or as directed by COR.
c) Number of AC power outlets: Minimum 4-20 A receptacles.
d) Enclosure: Fully self-contained, metal 102 mm (4 inch) x 102 mm (4 inches) x 64 mm (2-1/2 inches) with cover
e) Connection: Minimum 25.4 mm (1 inch) conduit connected to room's AC Power Panel, or as directed by COR
f) Number of boxes: One.
g) Compliance: NRTL (i.e. UL); NPFA - 70 (NEC).

i. AC Power Line Surge Protector and Filter Construction:
1) Input Voltage Range: 120 VAC + 15 percent at 50/60 Hz, single phase.
2) Power Service Capacity: 20 AMP, 120 VAC.
3) Voltage Output Regulation: +5.0 percent, instantaneous of input.
4) Circuit Breaker: 20 AMP; shall be self-contained.
5) AC Outlets: Minimum four duplex grounded NEMA 5-20R.
6) Response Time: 5.0 nano-second.
7) Suppression: Isolate and filter any noise, surge spikes
a) Surge: Minimum 20,000 AMP.
b) Noise:
1) Common: -40 dB.
2) Differential: -45 dB.
8) Clamping Voltage: Minimum 300 V.
9) Enclosure: One; self-contained.
10) Mounting: Internal to cabinet floor or on internal mounting rail shelf, allowing two plugs from two plug strips.
11) AC Power Cord: Required; minimum 1,628 mm (6 feet), three wire (green ground); minimum #14 AWG stranded.
12) Compliance: NRTL (i.e. UL60950-1).

j. Equipment Ground:
1) Cabinet Ground: Stainless steel adjustable, lug connected to cabinet's main structure providing an internal cabinet ground for all installed equipment properly bolted to rail and with ground wire connected.

k. Grounding Terminals: A separate mounting hole on equipment mounting rail, with stainless steel connecting bolt bonded by minimum #10 AWG copper wire to cabinet's internal grounding lug.

G. Wire Management Equipment:

1. Provide an orderly horizontal and vertical interface between outside and inside wires and cables, distribution and interface wires and cables, interconnection wires and cables and associated equipment, jumper cables, and provide a uniform connection media for system fire-retardant wires and cables and other subsystems.
2. Interface to each cable tray, duct, wireway, or conduit used in the system.
3. Interconnection or distribution wires and cables shall enter system at top (or from a wireway in the floor) via overhead protection system and be uniformly routed down both sides at same time, of the frames side protection system, then laterally for termination on rear of each respective terminating assembly.
4. Custom configure to meet 30 percent fill system design and user needs.
   a. Minimum Height: __72"___ .
   b. Minimum Depth: ____42"_ .
   c. Minimum Width: __30"___ .

H. Vertical Cable Managers:

1. Use same make, style and size of vertical cable manager on rack/frame or in between racks/frames when more than one cable manager is used on a rack/frame or group of racks/frames.
2. Match color and cover style of racks/frames and cable managers.

I. Horizontal Cable Managers:

1. Use same make and style of cable manager on rack/frame or racks/frames, when more than one horizontal cable manager is used on a rack/frame or group of racks/frames.
2. Match color of racks/frames and cable managers.

J. Provide installation hardware when enclosures or racks are attached to structural floor.

K. Provide noise filters and surge protectors for each equipment interface cabinet, switch equipment cabinet, control console, and local and remote active equipment locations to ensure protection from input

primary AC power surges so as a consequence noise glitches are not induced into low voltage data circuits.

2.2 SPARE PARTS

A. Provide one standalone open equipment rack.

B. Provide one AC power strip.

C. Provide on equipment vertical ground bus.

D. Provide one 3000 VA UPS.

E. Provide one AC power line surge protector and filter.

F. Provide one vertical and 3 horizontal wire management.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate cabinet installation such that doors fully close and lock, with active and passive equipment installed and connected.

B. Verify equipment dimensions and brackets allow mounting with cabinet doors closed. Front door or rear door of any cabinet that does not close and lock shall result in immediate cancellation of inspections or tests.

3.2 INSTALLATION

A. Equipment Cabinets:

1. Install cabinets in a manner that complies with OEM instructions, requirements of this specification, and in a manner which does not constitute a safety hazard.
2. Provide weatherproof equipment installed outdoors or install in NEMA 3S rated enclosures with hinged doors and locks with two keys.
3. Install equipment indoors in NEMA 4 rated metal cabinets with hinged doors and locks with two keys.

B. Grounding:

1. Bond equipment, including identified Government furnished equipment, to ground so total ground resistance measures maximum 0.1 Ohm.
   a. Install lightning arrestors and grounding in accordance with NFPA.
   b. Install gas protection devices at nearest point of entrance in buildings where protection is required and on same circuits as MDF in telephone switch room.
   c. Do not use AC neutral, including in power panel or receptacle outlet, for system control, subcarrier or audio reference ground.

d. Use of conduit, signal duct or cable trays as system or electrical ground is not permitted.

2. Connect each equipment grounding terminal to a separate mounting hole on equipment mounting rail, to right as one looks at it from rear, with a minimum #12 AWG stranded copper wire with protective green jacket.
3. Extend common ground bus of minimum #10 AWG solid copper wire throughout each equipment cabinet and bond to TGB. Provide a separate isolated ground connection from each equipment cabinet ground bus to system ground. Do not tie equipment ground buses together.
4. Bond equipment to cabinet bus with copper braid equivalent to #12 AWG. Self-grounding equipment enclosures, racks or cabinets, that provide OEM certified functional ground connections through physical contact with installed equipment, are acceptable alternatives.
5. Bond cable shields to cabinet ground bus with minimum #12 AWG stranded copper wire at only one end of cable run. Insulate cable shields from each other, faceplates, equipment racks, consoles, enclosures or cabinets, except at system common ground point. Bond coaxial and audio cables only at source; in all cases, keep cable shield ground connections to a minimum.

C. Equipment Assembly:

1. Cabinets:
   a. Install and adjust cabinet/frame accessories to position, including thermal management accessories, vertical cable managers, vertical power managers and equipment-mounting rails, using manufacturer’s installation instructions prior to baying or placing cabinet for attachment to building and before installing any rack-mount equipment into cabinet. Shelves, horizontal cable managers and filler panels (rack-mount accessories), if used, shall be installed after cabinet is placed.
   b. When used in a multi-cabinet bay, attach cabinets side-by-side using baying kits according to manufacturer’s instructions.
   c. Attach overhead ladder rack or cable tray to ceiling or top of cabinet. Maintain minimum 75 mm (3 inches) clearance between top of cabinet and bottom of ladder rack/cable tray. Position ladder rack/cable tray so that it does not interfere with hot air

exhaust through cabinet’s top panel. Use radius drops where cable enters or exits ladder rack/cable tray.

d. In seismic areas, install additional bracing as required by building codes and recommendations of a licensed structural engineer.
e. Install ladder rack with side stringers facing rack or cabinet so that ladder forms an inverted U-shape and so that welds between stringers (sides) and cross members (middle) face away from cables.
f. Secure ladder rack to tops of equipment racks or cabinets using manufacturer’s recommended supports and appropriate hardware.
g. Attach bonding conductor sized per TIA-607-B between telecommunications grounding busbar and cabinet. Attach bonding conductor to cabinet using a ground terminal block according to manufacturer’s installation instructions.
h. Provide bonding conductor and other hardware required to make connections between cabinet and telecommunications grounding busbar.
i. Install rack mounted equipment normally requiring adjustment or observation so operational adjustments can be conveniently made.
j. Mount heavy equipment with rack slides or rails to allow servicing from front of enclosure. Provide support in addition to front panel mounting screws for heavy equipment.
k. Provide with cable slack to permit servicing by removal of installed equipment from front of enclosure.
l. Install color-matched blank panel spacer 44 mm (1.75 inches) high between each piece of active and passive equipment to ensure adequate air circulation for efficient equipment cooling and air ventilation.
m. Provide quiet fans and non-disposable air filters at each console or cabinet.
n. Install enclosures and racks plumb and square, permanently attached to building structure and held in place.
o. Provide 381 mm (15 inches) of front vertical space opening for additional equipment.

p. Install equipment located indoors in metal racks or enclosures with hinged doors to allow access for maintenance without causing interference to other nearby equipment.
q. Cables shall enter equipment racks or enclosures in such a manner to allow doors or access panels to open and close without disturbing or damaging cables.
r. Mount distribution hardware in a manner that allows access to connections for testing and provides room for doors or access panels to open and close without disturbing the cables.

2. Racks:
   a. Assemble racks according to manufacturer’s instructions.
   b. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching rack to floor.
   c. Attach assembled racks to floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods shall pass through raised floor tile and be secured in structural floor below.
   d. Bond racks to telecommunications grounding bus bar using appropriate hardware provided by contractor.
   e. In seismic areas, install additional bracing as required by building codes and recommendations of a licensed structural engineer.
   f. Ladder rack shall be attached to top of rack to deliver cables to rack. Do not drill rack to attach; use appropriate hardware from rack manufacturer.
   g. Provide radius drops to guide cable where cable exits or enters side of overhead ladder rack to access a rack, frame, cabinet or wall-mounted rack, cabinet or termination field.
   h. Evenly distribute equipment load on rack. Place large and heavy equipment towards bottom of rack. Secure equipment to rack with equipment mounting screws. In seismic areas, secure equipment to shelves with additional bracing.
3. Vertical Cable Managers:
   a. Provide vertical managers so number of cables in each manager does not exceed OEM fill capacity.
   b. Attach vertical cable managers to side of rack/frame using manufacturer’s installation instructions and hardware.

c. Attach vertical cable manager to both racks/frames when a single vertical cable manager is used between two racks/frames.
d. Dress cables through openings in between T-shaped guides on manager so that cables make gradual bends as they exit or enter cable manager into rack-mount space (RMU). Do not twist, coil or make sharp bends in cables.
e. Attach doors to cable manager in closed position after cabling is complete.

4. Horizontal Cable Managers:
   a. Attach horizontal cable managers to rack/frame with minimum four screws according to manufacturer’s installation instructions. Center each cable manager within allocated rack-mount space (RMU).
   b. Provide horizontal managers located so number of cables each manager supports is less than cable manager’s cable fill capacity.
   c. Dress cables through openings in between T-shaped guides on cable manager so that cables make gradual bends as they exit or enter cable manager into rack-mount space (RMU). Do not twist, coil or make sharp bends in cables.
   d. Attach covers to cable manager in closed position after cabling is complete.

D. Labeling: Permanently label each enclosure in accordance with TIA-606-B using a laser jet printer. Handwritten labels are not acceptable.
   1. Equipment: Label system equipment with contrasting plastic laminate or bakelite material on face of unit corresponding to its source.
   2. Conduit, Cable Duct, and/or Cable Tray: Label conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 m (10 feet), identifying system.

---END---

SECTION 27 11 26
COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies power distribution equipment and interconnections supporting equipment deployed in telecommunications spaces (including, but not limited to, entrance rooms, computer rooms, telecommunications rooms, and telecommunications enclosures).

1.2 SUMMARY

Section Includes:

A. Zone Power Distribution Units (Zone PDUs).

B. Rack-Mounted Uninterruptible Power Supply (UPS) Units.

C. Rack Power Distribution Units (Rack PDUs).

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK

A. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

1.5 SUBMITTALS

A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

B. For each type of product:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for rack-mounted power protection and power strips.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

PART 2 - PRODUCTS

2.1 ZONE POWER DISTRIBUTION UNIT (ZONE PDU, Z-PDU OR ZPDU)

A. Provide components from a single manufacturer. eConnect intelligent PDUs combines remote rack-level (cabinet-level) power monitoring and control, environmental monitoring and access control via a single appliance, software and network Ethernet connection. eConnect Monitored PDU provides rack-level power monitoring. Monitored Pro PDU provides rack and device (outlet) level power monitoring. Switched provides rack level power monitoring and individual outlet control. Switched Pro

provides rack level power monitoring, outlet level power monitoring and outlet level control.

B. 60 Amp Zone PDU:
   1. Description: Zone PDU with A/B redundant 3-phase 60A input circuits and three (3) pairs of A/B redundant L21-20R outlets allowing each supported Standard Density (5kW) enclosure to operate at full density rating.
   2. Input Connection: Dual 60A three-phase 208V hard-wired, with junction box and five-wire (L+L+L+N+G) DIN copper terminal blocks accommodating 4AWG conductors. Power cord 10’ (3m) length.
   3. Output Connection: Three (3) pairs of A/B (redundant) L21-20R outlets.
   4. Power Capacity: 43.2kW (21.6kW redundant at full load); 5.7kW fully rated at each L21-20R outlet.
   5. Enclosure: Fully self-contained.
   6. Mounting: Rack mounted, 2 rack units (RU) (3.35”).

C. 30 Amp Zone PDU:
   1. Description: Zone PDU with A/B redundant 3-phase 30A input circuits and two (2) pairs of A/B redundant L21-20R outlets allowing each supported Standard Density (5kW) enclosure to operate at partial density rating.
   2. Input Connection: Dual 30A three-phase 208V L21-30P. Power cord 10’ (3m) length.
   3. Output Connection: Two (2) pairs of A/B (redundant) L21-20P outlets.
   4. Power Capacity: 21.6kW (10.8kW redundant at full load); combined 8.6kW rated output through each A/B pair of L21-20R outlets.
   5. Enclosure: Fully self-contained.
   6. Mounting: Rack mounted, 2 rack units (RU) (3.35”).

2.2 RACK-MOUNTED UNINTERRUPTIBLE POWER SUPPLY (UPS) UNIT

A. Provide components from a single manufacturer.

B. In network channel racks, provide 5kW three-phase 208Y/120V 20A rack-mounted UPS.
   1. Input Connection: Single input NEMA L21-20P (locking type plug three-phase, five wire: L+L+L+N+G), with minimum 10’ (3m) power cord.

a. For Computer Room applications: Minimum 30 each C13 and 6 each C19. Outlets grouped in phase-grouping banks (A-B, B-C, C-A) or alternating to assist with phase balancing. Outlets labelled with associated phase-grouping bank.

b. For Telecommunications Room (TR) and entrance room applications: Minimum 30 each C13, 6 each C19, 2 each L5-20. Outlets grouped in phase-grouping banks (A-B, B-C, C-A) or alternating to assist with phase balancing. Outlets labelled with associated phase-grouping bank.

2. Power Capacity: 5kW
3. Enclosure: Fully self-contained.
4. Mounting: rack mounted, 19” height.
5. Battery Capacity: Ten minutes at 70% load (3.5kW).
6. Cooling: Fan-cooled, front air entry, rear exhaust.

C. In Telecommunications Enclosures, provide 2880VA single-phase 120V 30A rack-mounted UPS.

1. Input Connection: Single input NEMA L5-30P (30A locking type plug, single-phase, three wire L+N+G), with minimum 3’ (1m) length.
2. Output Connection: Single output NEMA L5-30R (30A locking type receptacle, single-phase, three wire L+N+G).
3. Power Capacity: 2880VA.
4. Enclosure: Fully self-contained.
5. Mounting: rack mounted, 2 rack units (RU) (3.35”).
6. Battery Capacity: Ten minutes at 70% load (2000VA).
7. Cooling: Fan-cooled, front air entry, rear exhaust.

2.3 RACK POWER DISTRIBUTION UNIT (RACK PDU)

A. Provide components from a single manufacturer.

B. In network channel racks, provide metered/monitored three-phase 208V 20A vertical Rack Power Distribution Unit (rPDU), 5.7kW, with IEC60320 outlets.

1. Input Connection: Single input NEMA L21-20P (locking type plug three-phase, five wire: L+L+L+N+G), with minimum 10’ (3m) power cord.
2. Output Connections.

a. For Computer Room applications: Minimum 30 each C13 and 6 each C19. Outlets grouped in phase-grouping banks (A-B, B-C, C-A) or

alternating to assist with phase balancing. Outlets labelled with associated phase-grouping bank.

b. For Telecommunications Room (TR) and entrance room applications: Minimum 30 each C13, 6 each C19, 2 each L5-20. Outlets grouped in phase-grouping banks (A-B, B-C, C-A) or alternating to assist with phase balancing. Outlets labelled with associated phase-grouping bank.

3. Power Capacity: 5.7kW rated.
4. Enclosure: Fully self-contained.
5. Mounting: Toolless mounting, orientation vertical at rear of enclosure, taking up zero RU spaces. Up to two Rack PDUs must be able to be installed on each side for High Density (10kW) enclosures.
6. Mounting Hardware: As required to connect to the specific enclosure make/model.
7. Number of RPDUs: 2 for Standard Density (up to 5kW) enclosures, 4 for High Density (10kW) enclosures.
8. Metering: Local display provides input line currents (Amperage). Additional metering items (voltage, power, energy, power factor) across the unit or at individual outlets, is acceptable.
9. Monitoring: RJ45 Ethernet port allows connection to an external monitoring system. Supports SNMP v3 with SSL Encryption.

C. In Telecommunications Enclosures (TEs), provide single-phase 120V 30A horizontally rack mounted Power Distribution Unit (hPDU) with 5-20R outlets.

1. Output Connection: Ten (10) NEMA 5-20R outlets.
2. Power Capacity: 2880VA.
3. Enclosure: Fully self-contained.
4. Mounting: Horizontal, rack-mounted at the rear of the enclosure, 1 rack unit (RU).

PART 3 - EXECUTION

3.1 INSTALLATION

A. DEFINITION: Sides (left/right) of the enclosure are as when viewed from the rear (hot aisle) of the enclosure for the purposes of this section.

B. Zone PDUs.

1. Install Zone PDUs only in enclosures that require them.

2. Zone PDUs shall not be installed in the following scenarios:
   a. In enclosures supported by busbar power distribution.
   b. In network channel racks that are in telecommunications rooms (TRs) with only a single rack.
   c. In Telecommunications Enclosures (TEs).
3. Install Zone PDUs beginning in RU position 1 or the first open RU position above any rack-mounted UPS unit, at the bottom of the 19” rack, on the rear rails of the enclosure.
4. Connect the Zone PDU power cords to the upstream branch circuit supporting the enclosures.

C. Rack-Mounted UPS Units.
1. Install rack-mounted UPS units only in enclosures that require them. Rack-mounted UPS units shall not be installed downstream of another UPS system (cascaded).
2. Where non-redundant UPS power is required to support the enclosure, install the rack-mounted UPS unit in the A side power distribution.
3. Install rack-mounted UPS units beginning in RU position 1, at the bottom of the 19” rack, with the exhaust ports facing the rear of the enclosure. No other equipment should be installed below the rack-mounted UPS units.
4. In network channel racks, connect the rack-mounted UPS unit power cord to the appropriate (A side) power receptacle on the upstream Zone PDU.
5. In Telecommunications Enclosures (TEs), connect the 2880VA UPS unit power cord to the appropriate wall-mounted Essential Electrical System branch receptacle, unless otherwise indicated on the Contract Drawings.

D. Vertical Rack PDUs (rPDUs).
1. Install rPDUs only in Network Channel Racks, as indicated in the Contract Drawings.
2. Install rPDUs in matched A/B pairs only.
3. Install A side Rack PDUs on the left side of the enclosure and B side Rack PDUs on the right side of the enclosure, interior to the rear enclosure door.
4. Connect the Rack PDU power cord to the upstream rack-mounted UPS unit (where present) or the appropriate power receptacle on the

upstream Zone PDU, or as otherwise indicated in the Contract Drawings.

E. Horizontal Rack PDUs (hPDUs).

1. Install hPDUs only in Telecommunications Enclosures, as indicated in the Contract Drawings.
2. Install hPDUs in matched A/B pairs only. Connect one hPDU to the wall-mounted normal power receptacle and connect the other to the output of the 2880VA UPS.
3. Install above the 2880VA UPS, as shown in the Contract Drawings.

- - - E N D - - -

SECTION 27 15 00
COMMUNICATIONS STRUCTURED CABLING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies a complete and operating voice and digital structured cabling distribution system and associated equipment and hardware to be installed in VA Salem Medical Center here-in-after referred to as the “facility”.

1.2 RELATED WORK

A. Wiring devices: Section 26 27 26, WIRING DEVICES.

B. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

C. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

D. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

Low voltage cabling system infrastructure: Section 27 10 00, CONTROL, COMMUNICATION AND SIGNAL WIRING.

1.3 SUBMITTALS

A. In addition to requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS provide:

1. List of test equipment as per Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

B. Certifications:

1. Submit written certification from OEM indicating that proposed supervisor of installation and proposed provider of contract maintenance are authorized representatives of OEM. Include individual's legal name and address and OEM warranty credentials in the certification.
2. Pre-acceptance Certification: Submit in accordance with test procedures.
3. Test system cables and certify to COR before proof of performance testing can be conducted. Identify each cable as labeled on as-installed drawings.

4. Provide current and qualified test equipment OEM training certificates and product OEM installation certification for contractor installation, maintenance, and supervisory personnel.

C. Closeout Submittal: Provide document from OEM certifying that each item of equipment installed conforms to OEM published specifications.

1.4 WARRANTY

A. Work subject to terms of Article "Warranty of Construction," FAR clause 52.246-21.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Provide complete system including “punch down” and cross-connector blocks voice and data distribution sub-systems, and associated hardware including telecommunications outlets (TCO); copper and fiber optic distribution cables, connectors, “patch” cables, “break out” devices and equipment cabinets, interface cabinets, and radio relay equipment rack.

B. Industry Standards:

1. Cable distribution systems provided under this section are connected to systems identified as critical care performing life support functions.
2. Conform to National and Local Life Safety Codes (whichever are more stringent), NFPA, NEC, this section, Joint Commission Life Safety Accreditation requirements, and OEM recommendations, instructions, and guidelines.
3. Provide supplies and materials listed by a nationally recognized testing laboratory where such standards are established for supplies, materials or equipment.
4. Refer to industry standards and minimum requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and guidelines listed.
5. Active and passive equipment required by system design and approved technical submittal; shall conform to each UL standard in effect for equipment, when technical submittal was reviewed and approved by Government or date when COR accepted system equipment to be replaced. Where a UL standard is in existence for equipment to be used in

completion of this contract, equipment shall bear approved NRTL label.

C. System Performance: Provide complete system to meet or exceed TIA Category 6A requirements.

D. Provide continuous inter- and/or intra-facility voice, data, and analog service.

1. Provide voice and data cable distribution system based on a physical "Star" topology.
2. Provide separate cable distribution system for emergency, safety and protection systems (i.e. emergency bypass phones; police emergency voice communications from parking lots and stairwells personal protection, duress alarms and annunciation systems.)
3. Contact SMCS 005OP2H3 (202-462-5310) for specific technical assistance and approvals.

E. Specific Subsystem Requirements: Provide products necessary for a complete and functional voice, data, analog and videotele communications cabling system, including backbone cabling system, patch panels and cross-connections, horizontal cabling systems, jacks, faceplates, and patch cords.

F. Coordinate size and type of conduit, pathways and firestopping for maximum 40 percent cable fill with subcontractors.

G. Terminate all interconnecting twisted pair, fiber-optic or coaxial cables on patch panels or punch blocks. Terminate unused or spare conductors and fiber strands. Do not leave unused or spare twisted pair wire, fiber-optic or coaxial cable unterminated, unconnected, loose or unsecured.

H. Color code distribution wiring to conform to ANSI/TIA 606-B and construction documents, whichever is more stringent. Label all equipment, conduit, enclosures, jacks, and cables on record drawings, to facilitate installation and maintenance.

I. In addition to requirements in Section 27 05 11, REQUIREMENTS FOR COMMUNICATION INSTALLATIONS, provide stainless steel faceplates with plastic covers over labels.

2.2 EQUIPMENT AND MATERIALS

A. Cable Systems - Twisted Pair, Fiber optic, Coaxial and Analog:

1. General:

a. Provide cable (i.e. backbone, outside plant, and horizontal cabling) conforming to accepted industry standards with regards to size, color code, and insulation.
b. Some areas can be considered “plenum”. Comply with all codes pertaining to plenum environments. It is contractor’s responsibility to review the VA’s cable requirements with COR and OI&T Service prior to installation to confirm type of environment present at each location.
c. Provide proper test equipment to confirm that cable pairs meet each OEM’s standard transmission requirements, and ensure cable carries data transmissions at required speeds, frequencies, and fully loaded bandwidth.

2. Telecommunications Rooms (TR):
   a. In TR’s served with UTP and STP fiber optic, terminate UTP and STP cable on RJ-45, 8-pin connectors of separate 48-port modular patch panels, 110A or equivalent type punch down blocks that are dedicated to voice and data applications.
   b. Provide 24 port fiber optic modular patch panels with “LC” or OEM specified couplers dedicated for voice, data and FMS applications.
   c. Provide connecting cables required to extend backbone cables (i.e. patch cords, twenty-five pair.), to ensure complete and operational distribution systems.
   d. In TR’s, which are only served by a UTP and STP backbone cable, terminate cable on separate modular connecting devices, Type 110A punch down blocks (or equivalent), dedicated to data applications.
3. Backbone Copper Cables:
   a. Riser Cable:
      1) Provide communication riser cables listed in NEC Table 800, 154(a) for the purpose and suited for electrical connection to a communication network.
      2) Provide STP or Unshielded Twisted Pair (UTP), minimum 24 American Wire Gauge (AWG) solid, thermoplastic insulated conductors for communication (analog RF coaxial cable is not to be provided in riser systems) riser cables with a thermoplastic outer jacket.

3) Label and test complete riser cabling system.

4. Horizontal Cable: Installed from TCO jack to the TR patch panel.
   a. Tested to ANSI/TIA-568-C.2-10, TSB-155 Category 6A requirements including NEXT, ELFEXT (Pair-to-Pair and Power Sum), Insertion Loss (attenuation), Return Loss, and Delay Skew.
   b. Minimum Transmission Parameters: 500 MHz CAT 6A.
   c. CAT 6A (10 Gigabit Ethernet (GbE))
   d. Provide four pair 0.326 mm2 (22 AWG) for Category 6A cable
   e. Terminate all four pairs on same port at patch panel in TR.
   f. Terminate all four pairs on same jack, at work area Telecommunication Outlets (TCO):
      1) Jacks: Minimum three eight-pin RJ-45 ANSI/TIA-568-C.2 Category 6A Type jacks at TCO.
         a) Top Port: RJ-45 jack compatible with RJ-11 plug for voice.
         b) Bottom Two Ports: Unkeyed RJ-45 jacks for data.
5. Fiber Optics Backbone Cable:
   a. Provide 50/125 micron OM4 multi-mode cable, containing at minimum 18 strands of fiber, unless otherwise specified.
   b. Provide tight buffered interlocked armored fiber cable for indoor/outdoor cables.
   c. Armored Cable construction:
      1. Optical fiber/glass core/cladding/coating/buffer.
      2. FR/UV Resistant inner jacket
      3. Rip cord.
      4. FR/UV resistant outer jacket
      5. Interlocking armor, aluminum or steel.
      6. Overall outer flame-retardant thermoplastic to meet OFCP (plenum conductive) and OFNP (plenum none conductive).
   d. Terminate multimode fibers at both ends with LC type female connectors installed in an appropriate patch or breakout panel and secured with a cable management system. Provide minimum 610 mm (2 ft.) cable loop at each end.
   e. Provide single mode OS2 fiber optic cable 8.3 mm containing at minimum 12 strands of fiber, unless otherwise specified. Terminate single mode fibers at both ends with LC type female connectors installed in an appropriate patch or breakout panel

and secured with a cable management system. Provide minimum 610 mm (2 feet) cable loop at each end to allow for future movement.

f. Install fiber optic cables in TR's, Voice (Telephone) Switch Room, and Main Computer Room, in rack mounted fiber optic patch panels. Provide female LC couplers in appropriate panel for termination of each strand.

g. Test all fiber optic strands' cable transmission performance in accordance with TIA standards. Measure attenuation in accordance with fiber optic test procedures TIA-455-C ('-61', or -53). Provide written results to COR for review and approval.

B. Cross-Connect Systems (CCS):

1. Copper Cables: Provide copper CCS sized to connect cables at TR and allow for a minimum of 50 percent anticipated growth.
2. Maximum DC Resistance per Cable Pair: 28.6 Ohms per 305 m (1,000 feet).
3. Fiber Optic Cables:
   a. Provide fiber CCS sized to connect cables at TR and allow for a minimum of 50 percent anticipated growth.
   b. Install fiber optic cable slack in protective enclosures.

C. Telecommunication Room (TR):

1. Terminate backbone and horizontal, copper, fiber optic, coaxial and analog cables on appropriate cross-connection systems (CCS) containing patch panels, punch blocks, and breakout devices provided in enclosures and tested, regardless of installation method, mounting, termination, or cross-connecting used. Provide cable management system as a part of each CCS.
2. Coordinate location in TR with FMS equipment (i.e. fire alarm, nurse call, code blue, video, public address, radio entertainment, intercom, and radio paging equipment).

D. Coaxial and Analog Cables: Bond equipment to ground per TIA standards, such that all grounding systems comply with all applicable National, Regional, and Local Building and Electrical codes.

1. Provide current arrester for each copper or coaxial cable that enters from outside of a building regardless if cable is installed underground or aerial.
2. Provide a gas surge protector/module and bond to earth ground.

E. Main Cross-connection Subsystem (MCCS): MCCS is common point of distribution for inter- and intra-building copper and fiber optic backbone system cables, and connections to the voice (telephone) and data cable systems.

F. Voice/Data (or Telephone) Cable Cross-Connection Subsystem:

1. Provide Insulation Displacement Connection (IDC) hardware.
2. Provide the following for each Category 6A Cabling System termination, RJ-45 patch cord connector to RJ-45 patch cord connector.
   a. Provide terminations to be accessible without need for disassembly of IDC wafer. Provide IDC wafers removable from their mounts to facilitate testing on either side of connector.
   b. Provide removable designation strips or labels to allow for inspection of terminations.
   c. Provide cable management system as a part of IDC.
3. Provide IDC connectors capable of re-terminations, without damage, a minimum of 200 IDC insertions or withdrawals on either side of connector panel.
4. Install using only non-impact terminating tool having both a tactile and an audible feedback to indicate proper termination.
5. Provide inputs from PBX, FTS, Local Voice (Telephone) System, or diverse routed voice distribution systems on left side of IDC (110A blocks with RJ45 connections are acceptable alternates to IDC) of MCCS.
6. Provide system outputs from MCCS to voice backbone cable distribution system on the right side of same IDC (or 110A blocks) of MCCS.
7. Do not split pairs within cables between different jacks or connections.
8. Provide UTP cross connect wire to connect each pair of terminals plus an additional 50 percent spare.

G. Data Cross-Connection Subsystems:

1. Provide patch panels with modular RJ45 female to 110 connectors for cross-connection of copper data cable terminations and system ground with cable management system.
2. Provide patch panels conforming to EIA/ECA 310-E dimensions and suitable for mounting in standard equipment racks, with 48 RJ45 jacks aligned in two horizontal rows per panel. Provide RJ45 jacks of

modular design and capable of accepting and functioning with other modular (i.e. RJ11) plugs without damaging jack.

a. Provide system inputs from servers, data LAN, bridge, or interface distribution systems on top row of jacks of appropriate patch panel.
b. Provide backbone cable connections on bottom row of jacks of same patch panel.
c. Provide patch cords for each system pair of connection jacks with modular RJ45 connectors provided on each end to match panel's modular RJ45 female jack's being provided.

H. Fiber-Optic Cross-Connection Subsystems: Provide rack mounted patch or distribution panels installed inside a lockable cabinet or "breakout enclosure" that accommodate minimum 12 strands multimode fiber and 12 strand single mode fiber - these counts do not include 50 percent spare requirement. Provide cable management system for each panel.

1. Provide panels for minimum 24 female LC connectors, able to accommodate splices and field mountable connectors and have capacity for additional connectors to be added up to OEM's maximum standard panel size for this type of use. Protect patch panel sides, including front and back, by a cabinet or enclosure.
2. Provide panels that conform to EIA/ECA 310-E dimensions suitable for installation in standard racks, cabinets, and enclosures.
3. Provide patch panels with highest OEM approved density of fiber LC termination's (maximum of 72 each), while maintaining a high level of manageability. Provide proper LC couplers installed for each pair of fiber optic cable LC connectors.
   a. Provide system inputs from interface equipment or distribution systems on top row of connectors of appropriate patch panel.
   b. Provide backbone cable connections on bottom row of connectors of same patch panel.
   c. Provide patch cords for each pair of fiber optic strands with connector to match couplers.
4. Provide field installable connectors that are pre-polished.
   a. Terminate every fiber cable with appropriate connector, and test to ensure compliance to specifications and industry standards for fiber optic LC female connector terminated with a fiber optic cable.

b. Install a terminating cap for each unused LC connector.

I. Horizontal Cabling (HC):

1. Horizontal cable length to farthest system outlet to be maximum of 90 m (295 ft).
2. Splitting of pairs within a cable between different jacks is not permitted.

J. Air Blown Fiber: Alternative fiber optic cable installation method.

1. Air blown fiber installation process (also referred to as air blown cable, air assisted cable, high pressure air blowing, cable jetting, and referred to as air blown fiber herein) typically uses separate optical fiber cables along with separate flexible protective microducts installed where optical fiber cables can be blown in using specific equipment, trained installation personnel and practices.
2. Indoor Microducts:
   a. Provide empty bundled microducts comprising an inner layer of microducts optimized for air blown fiber system and an outer jacket layer of plenum riser general purpose rated material with product identification and sequential length marking on outer layer at minimum one-meter (three feet) intervals.
   b. Provide microduct allowing multiple fibers to be installed simultaneously into each microduct using air blown fiber installation technique and fibers to also be removed from microduct using same technique.
   c. Size each microduct for 50 percent unoccupied microducts after initial fiber bundle installation.
   d. Furnish microducts that maintain minimum bend radius of 20 times cable diameter.
   e. Provide quantity of plugs or end-caps so all unoccupied microducts are plugged on both ends per manufacturer’s specifications. Provide plugs or end-caps that can be easily installed or removed from duct connectors as needed over the lifetime of the installation.
3. Outside Microducts:
   a. Provide outdoor-rated bundled microducts consisting of a number of empty microducts comprising an inner layer of microducts optimized for air blown fiber system and covered by a rated jacketing material with product identification and sequential

length marking on outer layer at one-meter (three feet) minimum intervals.

b. Provide microducts with rodent protection at direct buried applications.

c. Protect outdoor-rated bundled microducts either by utilizing a moisture barrier and an outer jacket outerlayer of jacketed, galvanized steel armored (underground), direct buried, or outdoor tray or rack locations UV resistant for aerial, outdoor rack or tray applications jacketed, galvanized steel armored for aerial, outdoor rack or tray locations or by utilizing an HDPE jacket (with optional steel-tape wrapped between outer jacket and inner microducts) that has been treated with rodent deterent.

d. Water-blocking shall be accomplished by utilizing a moisture barrier within the bundled microduct assembly or by utilizing water-blocked fiber cable.

e. Provide microduct allowing multiple fibers to be installed simultaneously into each microduct using air blown fiber installation technique and fibers to also be removed from microduct using same technique.

f. For future capacity, size each microduct provided for 50 percent unoccupied microducts after initial fiber bundle installation.

g. Furnish microducts to maintain minimum bend radius twenty times cable diameter.

h. Provide quantity of plugs or end-caps so unoccupied microducts are plugged on both ends per manufacturer’s specifications, to prevent ingress of contaminants including water.

4. Microduct Couplers: Provide plastic-bodied pneumatic connector to join microducts of same size.

a. Provide straight connectors constructed of a transparent plastic material permitting a visual verification of fiber population.

b. Provide tee connectors with additional port allowing for gas-blocking in internal/external situations, or provide gas-blocking couplers as needed to protect and isolate classified areas from non-classified areas or provide close-down connectors if needed for midspan assisted blows in long runs

5. Microduct Distribution Units: Provide NEMA-rated enclosure, suited for site environmental conditions provided for microduct distribution, routing, and termination.
   a. Provide unit capable of wall mounting to provide proper geometry for distribution wherever several microducts enter same location or where microduct type transitions take place.
   b. Size based on number of microducts to enter unit.
6. Outdoor Enclosure/Splice Case: Provide outdoor NEMA-rated enclosure, or splice case suitable for site environmental conditions of outside plant microduct distribution and routing.
   a. Splice Cases: Water-tight, and air-tight re-enterable splice cases that do not require re-entry kits.
   b. Material: Stainless steel.
   c. Select enclosure/splice case hardware to meet site conditions.
      1) Provide NEMA-4 and 4X enclosures or splice cases in areas where hosing and splashing environmental conditions exist.
      2) Provide NEMA-6 and 6P enclosures splice cases in areas where temporary or long term flooded environmental conditions exist.
7. Fiber Termination Units: Provide at locations where fiber is to be terminated.
   a. Provide for strain relief of incoming microducts.
   b. Provide connector panels and connector couplings adequate to accommodate the number of fibers to be terminated.
   c. Incorporate radius control mechanisms to limit bending of fibers to manufacturer’s recommended minimum or 76 mm (3 inches), whichever is larger.
   d. Where rack-mount fiber termination hardware is required, provide wall-mount microduct distribution unit near rack and provide individual microducts to route and connect fiber bundle passing through microduct distribution units to fiber termination hardware.
   e. Provide LC connectors mounted on a coupler panel that snaps into patch panel housing assembly.
8. Fiber Bundles or Cables:
   a. Provide fiber bundles or cables designed and manufactured to facilitate:

1) Rapid installation of fiber using air blown fiber installation process without risk or damage to fibers.
2) Re-installation without degradation of the optical specifications and performance of fiber.
3) Transition points from indoor to outdoor environments without splices.

b. Provide jacketed optical fibers manufactured so that the jacketed fiber strands meet GR409 and meet either UL 1666 for riser rated cables or UL 910 for plenum rated cables and are specific to the purpose of being blown throughout the bundled microduct system.
c. Provide fiber designed to be stripped and terminated with standard tools.
d. Provide fiber designed to be terminated with standard fiber optic connectors.
e. Provide maximum 72 strands of fiber to be blown within each microduct; if fiber counts higher than 72 strands are required, provide microcore fiber with counts to 432 strands in larger size microducts.

2.3 DISTRIBUTION EQUIPMENT AND SYSTEMS

A. Telecommunication Outlet:

1. TCO consists of minimum one voice (telephone)with six port position RJ45 jack and three data RJ45 jacks mounted in a separate steel outlet box 100 mm (4 inches) x 100 mm (4 inches) x 63 mm (2-1/2 inches) minimum with a labeled stainless steel faceplate. Where shown on drawings, provide a second steel outlet box minimum 100 mm (4 inches) x 100 mm (4 inches) x 63 mm (2-1/2 inches), with a labeled faceplate, adjacent to first box to ensure system connections and expandability requirements are met.
2. Provide RJ-45/11 compatible female type voice (telephone) multi-pin connections. Provide RJ-45 female type data multi-pin connections.
3. Provide wall outlet with a stainless steel face plate and sufficient ports to fit voice (telephone) multi-pin jack, data multi- pin jacks and plastic covers for labels when mounted on outlet box provided (minimum 100mm (4 inches) x 100mm (4 inches) for single and 100mm (4 inches) x 200mm (8 inches) for dual outlet box applications. Install stainless steel face plate, for prefabricated bedside patient unit installations.

4. Interface fiber optic LC jacks to appropriate patch panels in associated TR, but do not cross-connect fiber optic cables fiber optic equipment or install fiber optic equipment.

B. Backbone Distribution Cables:

1. Provide cable listed for environments where it is installed.
2. Technical Characteristics:
   a. Length: As required, in minimum 1 kilometer (3,000 ft.) reels.
   b. Meet TIA transmission performance requirements for voice grade Category 5E.
   c. Size:
      1) Minimum 0.326 mm2 (22 AWG) outside plant installation.
      2) Minimum 0.205 mm2 (24 AWG) interior installations.
   d. Color Coding: American Telephone and Telegraph Company Standard; Bell System Practices Outside Plant Construction and Maintenance Section G50.607.3, Issue 2 February, 1959.
   e. Minimum Bend Radius: 10X cable outside diameter.
   f. Impedance: 120 Ohms + 15 percent.
   g. DC Resistance: Maximum 8.00 ohms/100 m
   h. Maximum attenuation for 100m at 20° C:

Frequency (MHz)	Category 5e (dB)
.772	-
1	2.0
4	4.1
8	5.8
10	6.5
16	8.2
20	9.3
25	10.4
31.25	11.7
62.5	17.0
100	22.0
200	
250	

Frequency (MHz)	Category 5e (dB)
300	
400	
500	

3. Data and Voice Multi-Conductor:
   a. Unshielded F/UTP cable with solid conductors.
   b. Able to handle the power and voltage used over the distance required.
   c. Meets TIA transmission performance requirements of Category 6A.
   d. Meets or exceeds TIA-EIA-568-C.2-10, TSB-155.
   e. Technical Characteristics:
      1) 0.326 mm2 (22 AWG) cable
      2) Working no shielded: 300 Volts.
      3) Working Shield: 350 V.
      4) Bend Radius: 10 times cable outside diameter.
      5) Impedance: 100 Ohms + 15%, BAL.
      6) Bandwidth: 500 MHz for CAT 6A.
      7) DC Resistance: Maximum 9.38 Ohms/100m (328 ft.) at 20 degrees C.
      8) Maximum Mutual Capacitance: 5.6 nF per 100 m (328 ft.).
      9) Data cable color: BLUE
      10) CMR (riser) Cable shall have star filler and rip cord.
      11) CMP (plenum) cable shall have filler and rip cord.
      12) NEXT loss headroom +5dB
      13) PSNEXT loss Headroom +5dB
      14) ACRF headroom +6dB
      15) PSACRF headroom +6dB
      16) Shield Coverage:
         a) Overall Outside (if OEM specified): 100 percent.
         b) Individual Pairs (if OEM specified): 100 percent.
      17) Maximum attenuation for 100m (328 ft.) at 20° C:

Frequency (MHz)	Category 6A (dB)
1	2.1
4	3.8

Frequency (MHz)	Category 6A (dB)
8	5.3
10	5.9
16	7.5
20	8.4
25	9.4
31.25	10.5
62.5	15.0
100	19.1
200	27.6
250	31.1
300	34.3
400	40.1
500	45.3

4. Fiber Optic:
   a. Multimode Tight Fiber:
      1) Provide multi-mode OM4 Type Tight Buffered Interlocked Armored multimode fiber optic cable installed in conduit for system locations with load-bearing support braid surrounding inner tube for strength during cable installation.
      2) Technical Characteristics:
         a) Bend Radius: Minimum 152 mm (6 inches); outer jacket as required.
         b) Fiber Diameter: 50 microns.
         c) Cladding: 125 microns.
         d) Attenuation:
            1) 850 nanometer: Maximum 4.0 dB per kilometer.
            2) 1,300 nanometer: Maximum 2.0 dB per kilometer.
         e) Bandwidth:
            1) 850 nanometer: Minimum 160 MHz.
            2) 1,300 nanometer: Minimum 500 MHz.
         f) Connectors: Stainless steel.

g) Steel or Aluminum interlocking armor with outer jacket

b. Single mode Tight Fiber:

1) Provide OS2 Type Tight Buffered Interlocked Armored Single-mode fiber optic cable installed in conduit for all system locations with load-bearing support braid surrounding inner tube for strength during cable installation.

2) Technical Characteristics:

a) Bend Radius: Minimum 100 mm (4 inches).

b) Outer Jacket: PVC.

c) Fiber Diameter: 8.7 microns.

d) Cladding: 125 microns.

e) Attenuation at 850 nanometer: 1.0 dBm per kilometer.

f) Connectors: Ceramic.

g) Steel or aluminum interlocking armer with outer jacket

C. Outlet Connection Cables:

1. Data:

a. Provide a connection cable for each TCO data jack in system with 10 percent spares to connect a data instrument to TCO data jack. Do not provide data terminals/equipment.

b. Technical Characteristics:

1) Length: Minimum 1.8 m (6 feet).

2) Cable: Category 6A.

3) Connector: CAT 6A RJ-45 male on each end.

4) Color Coding: Required, data industry standard.

5) Size: Minimum 22 AWG for CAT 6A.

2. Voice (Telephone):

a. Provide a connection cable for each TCO voice (telephone) jack in system with 10 percent spares able to connect voice (telephone) connection cable from voice (telephone) instrument to TCO voice (telephone) jack. Do not provide voice (telephone) instruments or equipment.

b. Technical Characteristics:

1) Length: Minimum 1.8 m (6 feet).

2) Cable: Same as data.

3) Connector: CAT6A RJ-11/45 compatible male on each end.

4) Size: Minimum 22 AWG.

5) Color Coding: Required, telephone industry standard.

3. Fiber Optic:
   a. Provide a connection cable for each TCO fiber optic connector in system with 10 percent spares. Provide data connection cable to connect a fiber optic instrument to TCO fiber optic jack. Do not provide fiber optic instruments/equipment.
   b. Technical Characteristics:
      1) Length: Minimum 1.8 m (6 feet).
      2) Cable: Flexible single conductor with jacket.
      3) Connector: LC male on each end.
      4) Size: To OM4 multimode cable.

D. System Connectors:
1. Modular (RJ-45/11 and RJ-45): Provide voice and high-speed data transmission applications type modular plugs compatible with voice (telephone) instruments, computer terminals, and other type devices requiring linking through modular telecommunications outlet to the system compatible with UTP cables.
   a. Technical Characteristics:
      1) Number of Pins:
         a) RJ-45: Eight.
         b) RJ-11/45: Compatible with RJ-45.
      2) Dielectric: Surge.
      3) Voltage: Minimum 1,000V RMS, 60 Hz at one minute.
      4) Current: 2.2A RMS at 30 minutes or 7.0A RMS at 5.0 seconds.
      5) Leakage: Maximum 100 µA.
      6) Connections:
         a) Initial contact resistance: Maximum 20 milli-Ohms.
         b) Insulation displacement: Maximum 10 milli-Ohms.
         c) Interface: shall interface with modular jacks from a variety of OEMs. RJ-11/45 plugs provide connection when used in RJ-45 jacks.
         d) Durability: Minimum 200 insertions/withdrawals.

E. Fiber Optic Terminators:
1. Pre-polished crimp on type that has proper ferrule to terminate fiber optic cable.
2. Technical Characteristics:
   a. Frequency: Light wave.
   b. Power Blocking: As required.

c. Return Loss: 25 dB.

d. Connectors: LC.

e. Construction: Ceramic.

F. Conduit and Signal Ducts:

1. Conduit:

a. Provide conduit or sleeves for cables penetrating walls, ceilings, floors, interstitial space, fire barriers.

b. Minimum Conduit Size: 31 mm (1-1/4 inch).

c. Provide separate conduit and signal ducts for each cable type installation.

d. When metal (plastic covered, flexible cable protective armor.) systems are authorized to be provided for use in system, follow installation guidelines and standard specified in Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS and NEC.

e. Maximum 40 percent conduit fill for cable installation.

2. Signal Duct, Cable Duct, or Cable Tray: Use existing signal duct, cable duct, and cable tray, when identified and accepted by COR.

3. Provide inner duct for all fiber cable runs indoor or outdoor.

2.4 PATCH CORDS

A. Copper patch cords in Telecommunications Rooms:

1. Provide one patch cord for every port/terminated cable.

2. Provide 50% 5-foot-long, 30% 7-foot-long and 20% 15-foot-long.

3. Provide 10% spares for each length, minimum of 15 each for each length.

B. Copper connection/patch cords at the data jacks (TCO):

1. Provide 15-foot patch cords for each location plus 10% spare.

C. Fiber patch cords in Telecommunications Rooms:

1. Provide 10-3 meter duplex fiber optic patch cords.

2. Provide 10% spare with a minimum of 6.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install for ease of operation, maintenance, and testing.

B. Install system to comply with NFPA 70 National Electrical Code, NFPA 99 Health Care Facilities, NFPA 101 Life Safety Code, Joint Commission

Manual for Health Care Facilities, and original equipment manufacturers' (OEM) installation instructions.

C. Cable Systems Installation:

1. Install system cables in cable duct, cable tray, cable runway, conduit or when specifically approved, flexible NEC Article 800 communications raceway. Confirm drawings show sufficient quantity and size of cable pathways. If flexible communications raceway is used, install in same manner as conduit.
2. Coordinate outside plant and backbone cables to furnish number of cable pairs for system requirements and obtain approval of COR and IT Service prior to installation.
3. Bond to ground metallic cable sheaths. (i.e., risers, underground, horizontal.).
4. Install temporary cable to not present a pedestrian safety hazard and be responsible for all work associated with removal. Temporary cable installations are not required to meet Industry Standards; but, shall be reviewed and accepted by COR, IT Service, FMS and SMCS 005OP2H3 (202-461-5310) prior to installation.
5. Provide innerduct in each outdoor conduit, minimum of 2-11/4 inch.
6. Run indoor fiber in indoor innerduct

D. Labeling:

1. Industry Standard: Provide labeling in accordance with ANSI/TIA-606-B.
2. Print lettering of labels with laser jet printers; handwritten labels are not acceptable.
3. Label both ends of all cables in accordance with industry standard. Provide permanent Labels in contrasting colors and identify according to system “Record Wiring Diagrams”.
4. Termination Hardware: Label workstation outlets and patch panel connections using color coded labels with identifiers in accordance with industry standard and record on “Record Wiring Diagrams”.

E. Cable Slack

1. Provide 3 m (10 ft) in TR rooms for Copper balanced twisted pair cabling.
2. Provide 6 m (20 ft) in TR rooms for Fiber optical cabling.
3. Provide 1 m (3 ft) in the work area outlet for balanced twisted pair cabling.

4. Provide 1 m (3 ft) in the work area outlet for fiber optical cabling.

3.2 FIELD QUALITY CONTROL

A. Interim Inspection:

1. Verify that equipment provided adheres to installation requirements of this section. Interim inspection shall be conducted by a factory-certified representative and witnessed by COR.
2. Check each item of installed equipment to ensure appropriate NRTL label.
3. Verify cabling terminations in telecommunications rooms and at workstations adhere to color code for T568B pin assignments and cabling connections comply with TIA standards.
4. Visually confirm marking of cables, faceplates, patch panel connectors and patch cords.
5. Perform fiber optical field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.
6. Notify COR of the estimated date the contractor expects to be ready for interim inspection, at least 20 working days before requested inspection date, so interim inspection does not affect systems' completion date.
7. Provide results of interim inspection to COR. If major or multiple deficiencies are discovered, COR can require a second interim inspection before permitting contractor to continue with system installation.
8. Do not proceed with installation until COR determines if an additional inspection is required. In either case, re-inspection of deficiencies noted during interim inspections shall be part of the proof of performance test.

B. Pretesting:

1. Pretest entire system upon completion of system installation.
2. Verify during system pretest, utilizing the accepted equipment, that system is fully operational and meets system performance requirements of this section.
3. Provide COR four copies of recorded system pretest measurements and the written certification that system is ready for formal acceptance test.

C. Microduct Tests:

1. Furnish COR, obstruction and pressure test data for each microduct installed. Complete pressure and obstruction tests per manufacturer’s recommended procedures prior to installing fiber and ensure 100 percent of all microducts are compliant with manufacturer.
2. Complete microduct pressure testing before proceeding with end-to-end microduct obstruction testing.
3. Notify COR at least one week in advance of test date so that Government and design professional shall be present to witness testing.
4. Maintain close contact with chosen and technically-approved OEM and SMCS 005OP2H3 throughout installation, testing and certification process.

D. Acceptance Test:

1. After system has been pretested and the contractor has submitted pretest results and certification to COR, then schedule an acceptance test date and give COR 30 days' written notice prior to date acceptance test is expected to begin.
2. Test only in presence of a COR.
3. Test utilizing approved test equipment to certify proof of performance.
4. Verify that total system meets the requirements of this section.
5. Include expected duration of test time, with notification of the acceptance test.

E. Verification Tests:

1. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has an overall shield. Test cables after termination and prior to cross-connection.
2. Multi-mode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with TIA-568-B.3 and TIA-526-14A using Method A, Optical Power Meter and Light Source. Perform verification acceptance test.
3. Single mode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with TIA-568-B.3 and TIA-526-7 using Method A, Optical Power Meter and Light Source and Method B, OTDR. Perform verification acceptance test.

F. Performance Testing:

1. Perform Category 6A tests in accordance with TIA-568-B.1 and TIA-568-B.2. Include the following tests - wire map, length, insertion loss, return loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, propagation delay and delay skew.
2. Fiber Optic Links: Perform end-to-end fiber optic cable link tests in accordance with TIA-568-B.3.

G. Total System Acceptance Test: Perform verification tests for UTP copper cabling systems and multi-mode fiber optic cabling systems after complete telecommunication distribution system and workstation outlet are installed.

H. Fiber testing shall meet the following:
1. TIA 526-14 Optical Loss measurements of installed multi-mode fiber optic plant.
2. TIA 526-7 Measurement of Optical power loss of installed single-mode cable plant.
3. TIA/EIA-606 Administration standard for commercial telecommunications infrastructure.
4. TIA/EIA-A-1 Administration standard for communications infrastructure addendum 1-Adminidtration of equipment rooms and data center computer rooms.
5. ANSI/NECA/BICSI 568-2006 Standard for installing commercial building telecommunications cabling.

3.3 MAINTENANCE

A. Accomplish the following minimum requirements during one-year warranty period:
1. Respond and correct on-site trouble calls, during standard work week:
   a. A routine trouble call within one working day of its report. A routine trouble is considered a trouble which causes a system outlet, station, or patch cord to be inoperable.
   b. Standard work week is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal holidays.
2. Respond to an emergency trouble call within six hours of its report. An emergency trouble is considered a trouble which causes a subsystem or distribution point to be inoperable at any time.
3. Respond on-site to a catastrophic trouble call within four hours of its report. A catastrophic trouble call is considered total system failure.

a. If a system failure cannot be corrected within four hours (exclusive of standard work time limits), provide alternate equipment, or cables within four hours after four-hour trouble shooting time.
b. Routine or emergency trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units) are also be deemed as a catastrophic trouble.

4. Provide COR written report itemizing each deficiency found and the corrective action performed during each official reported trouble call. Provide COR with sample copies of reports for review and approval at beginning of total system acceptance test.

3.4 TESTING OF COMPLETD CABLING

A. Once UTP, SUTP and fiber data cabling has been pulled and terminated at both ends, the contractor shall test each cable run to confirm it is capable of supporting data transmission rates indicated in the bid document above and shall conforms to the cabling standards listed above.
B. The contractor shall supply a report documenting the test results.
C. The report shall be submitted in electronic format prior to acceptance by OIT.

---END---

---INTENTIONALLY BLANK---

SECTION 28 05 00
COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section, Common Work Results for Electronic Safety and Security (ESS), applies to all sections of Division 28.

B. Furnish and install fully functional electronic safety and security cabling system(s), equipment and approved accessories in accordance with the specification section(s), drawing(s), and referenced publications. Capacities and ratings of cable and other items and arrangements for the specified items are shown on each system's required Bill of Materials (BOM) and verified on the approved system drawing(s). If there is a conflict between contract's specification(s) and drawings(s), the contract's specification requirements shall prevail.

C. The Contractor shall provide a fully functional and operating ESS, programmed, configured, documented, and tested as required herein and the respective Safety and Security System Specification(s). The Contractor shall provide calculations and analysis to support design and engineering decisions as specified in submittals. The Contractor shall provide and pay all labor, materials, and equipment, sales and gross receipts and other taxes. The Contractor shall secure and pay for plan check fees, permits, other fees, and licenses necessary for the execution of work as applicable for the project. Give required notices; the Contractor will comply with codes, ordinances, regulations, and other legal requirements of public authorities, which bear on the performance of work.

D. The Contractor shall provide an ESS, installed, programmed, configured, documented, and tested. The security system shall include : physical access control, intrusion detection, duress alarms, elevator control interface, video assessment and surveillance, video recording and storage, delayed egress, personal protection system, intercommunication system, fire alarm interface, equipment cabinetry, dedicated photo badging system and associated live camera, report printer, photo badge printer, and uninterruptible power supplies (UPS) interface. Operator training shall not be required as part of the Security Contractors scope and shall be provided by the Owner. The Security Contractor shall

still be required to provide necessary maintenance and troubleshooting manuals as well as submittals as identified herein. The work shall include the procurement and installation of electrical wire and cables, the installation and testing of all system components. Inspection, testing, demonstration, and acceptance of equipment, software, materials, installation, documentation, and workmanship shall be as specified herein. The Contractor shall provide all associated installation support, including the provision of primary electrical input power circuits.

E. Repair Service Replacement Parts On-site service during the warranty period shall be provided as specified under “Emergency Service”. The Contractor shall guarantee all parts and labor for a term of one (1) year, unless dictated otherwise in this specification from the acceptance date of the system as described in Part 5 of this Specification. The Contractor shall be responsible for all equipment, software, shipping, transportation charges, and expenses associated with the service of the system for one (1) year. The Contractor shall provide 24-hour telephone support for the software program at no additional charge to the owner. Software support shall include all software updates that occur during the warranty period.

F. Section Includes:
   1. Description of Work for Electronic Security Systems,
   2. Electronic security equipment coordination with relating Divisions,
   3. Submittal Requirements for Electronic Security,
   4. Miscellaneous Supporting equipment and materials for Electronic Security,
   5. Electronic security installation requirements.

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 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.

D. Section 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.

E. Section 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Requirements for infrastructure.

F. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.

G. Section 28 23 00 - VIDEO SURVEILLANCE. Requirements for security camera systems.

1.3 DEFINITIONS

A. AGC: Automatic Gain Control.

B. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

C. BICSI: Building Industry Consulting Service International.

D. CCD: Charge-coupled device.

E. Central Station: A PC with software designated as the main controlling PC of the security access system. Where this term is presented with initial capital letters, this definition applies.

F. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel section.

G. Controller: An intelligent peripheral control unit that uses a computer for controlling its operation. Where this term is presented with an initial capital letter, this definition applies.

H. CPU: Central processing unit.

I. Credential: Data assigned to an entity and used to identify that entity.

J. DGP: Data Gathering Panel – component of the Physical Access Control System capable to communicate, store and process information received from readers, reader modules, input modules, output modules, and Security Management System.

K. DTS: Digital Termination Service: A microwave-based, line-of-sight communications provided directly to the end user.

L. EMI: Electromagnetic interference.

M. EMT: Electric Metallic Tubing.

N. ESS: Electronic Security System.

O. File Server: A PC in a network that stores the programs and data files shared by users.

P. GFI: Ground fault interrupter.

Q. IDC: Insulation displacement connector.

R. Identifier: A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of

identifying an individual. Where this term is presented with an initial capital letter, this definition applies.

S. I/O: Input/Output.

T. Intrusion Zone: A space or area for which an intrusion shall be detected and uniquely identified, the sensor or group of sensors assigned to perform the detection, and any interface equipment between sensors and communication link to central-station control unit.

U. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

V. LAN: Local area network.

W. LCD: Liquid-crystal display.

X. LED: Light-emitting diode.

Y. Location: A Location on the network having a PC-to-Controller communications link, with additional Controllers at the Location connected to the PC-to-Controller link with RS-485 communications loop. Where this term is presented with an initial capital letter, this definition applies.

Z. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

AA. M-JPEG: Motion - Joint Photographic Experts Group.

BB. MPEG: Moving picture experts group.

CC. NEC: National Electric Code

DD. NEMA: National Electrical Manufacturers Association

EE. NFPA: National Fire Protection Association

FF. NTSC: National Television System Committee.

GG. NRTL: Nationally Recognized Testing Laboratory.

HH. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

II. PACS: Physical Access Control System; A system comprised of cards, readers, door controllers, servers and software to control the physical ingress and egress of people within a given space

JJ. PC: Personal computer. This acronym applies to the Central Station, workstations, and file servers.

KK. PCI Bus: Peripheral component interconnect; a peripheral bus providing a high-speed data path between the CPU and peripheral devices (such as monitor, disk drive, or network).

LL. PDF: (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.

MM. RCDD: Registered Communications Distribution Designer.

NN. RFI: Radio-frequency interference.

OO. RIGID: Rigid conduit is galvanized steel tubing, with a tubing wall that is thick enough to allow it to be threaded.

PP. RS-232: An TIA/EIA standard for asynchronous serial data communications between terminal devices. This standard defines a 25-pin connector and certain signal characteristics for interfacing computer equipment.

QQ. RS-485: An TIA/EIA standard for multipoint communications.

RR. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.

SS. SMS: Security Management System – A SMS is software that incorporates multiple security subsystems (e.g., physical access control, intrusion detection, closed circuit television, intercom) into a single platform and graphical user interface.

TT. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

UU. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

VV. UPS: Uninterruptible Power Supply

WW. UTP: Unshielded Twisted Pair

XX. Workstation: A PC with software that is configured for specific limited security system functions.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

B. Product Qualification:

1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

C. Contractor Qualification:

1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of three (3) years' experience installing and servicing systems of similar scope and complexity. The Contractor shall be an authorized regional representative of the Security Management System's (PACS) manufacturer. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity which became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system. The references must include a current point of contact, company or agency name, address, telephone number, complete system description, date of completion, and approximate cost of the project. The owner reserves the option to visit the reference sites, with the site owner's permission and representative, to verify the quality of installation and the references' level of satisfaction with the system. The Contractor shall provide copies of system manufacturer certification for all technicians. The Contractor shall only utilize factory-trained technicians to install, program, and service the PACS. The Contractor shall only utilize factory-trained technicians to install, terminate and service controller/field panels and reader modules. The technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems. The Contractor shall have a local service facility. The facility shall be located within 4 hours 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 Contracting Officer of Record(COR) reserves the option of

surveying the company's facility to verify the service inventory and presence of a local service organization.

2. The Contractor shall provide proof project superintendent with BICSI Certified Commercial Installer Level 1, Level 2, or Technician to provide oversight of the project.
3. Cable installer must have on staff a Registered Communication Distribution Designer (RCDD) certified by Building Industry Consulting Service International. The staff member shall provide consistent oversight of the project cabling throughout design, layout, installation, termination and testing.

D. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 GENERAL ARANGEMENT OF CONTRACT DOCUMENTS

A. The Contract Documents supplement to this specification indicates approximate locations of equipment. The installation and/or locations of the equipment and devices shall be governed by the intent of the design; specification and Contract Documents, with due regard to actual site conditions, recommendations, ambient factors affecting the equipment and operations in the vicinity. The Contract Documents are diagrammatic and do not reveal all offsets, bends, elbows, components, materials, and other specific elements that may be required for proper installation. If any departure from the contract documents is deemed necessary, or in the event of conflicts, the Contractor shall submit details of such departures or conflicts in writing to the owner or owner's representative for his or her comment and/or approval before initiating work.

B. Anything called for by one of the Contract Documents and not called for by the others shall be of like effect as if required or called by all, except if a provision clearly designed to negate or alter a provision contained in one or more of the other Contract Documents shall have the intended effect. In the event of conflicts among the Contract Documents, the Contract Documents shall take precedence in the following order: the Form of Agreement; the Supplemental General

Conditions; the Special Conditions; the Specifications with attachments; and the drawings.

1.6 SUBMITTALS

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

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

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

1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
3. Submit each section separately.

D. The submittals shall include the following:

1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
2. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.

E. Submittals shall be in full compliance of the Contract Documents. All submittals shall be provided in accordance with this section. Submittals lacking the breath or depth these requirements will be considered incomplete and rejected. Submissions are considered multidisciplinary and shall require coordination with applicable divisions to provide a complete and comprehensive submission package. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted. Additional general provisions are as follows:

1. The Contractor shall schedule submittals in order to maintain the project schedule.
2. The Contractor shall identify variations from requirements of Contract Documents and state product and system limitations, which may be detrimental to successful performance of the completed work or system.
3. Each package shall be submitted at one (1) time for each review and include components from applicable disciplines (e.g., electrical work, architectural finishes, door hardware, etc.) which are required to produce an accurate and detailed depiction of the project.
4. Manufacturer’s information used for submittal shall have pages with items for approval tagged, items on pages shall be identified, and capacities and performance parameters for review shall be clearly marked through use of an arrow or highlighting. Provide space for COR and Contractor review stamps.
5. Technical Data Drawings shall be in the latest version of AutoCAD®, drawn accurately, and in accordance with VA CAD Standards CAD Standard Application Guide, and VA BIM Guide. FREEHAND SKETCHES OR COPIED VERSIONS OF THE CONSTRUCTION DOCUMENTS WILL NOT BE ACCEPTED. The Contractor shall not reproduce Contract Documents or copy standard information as the basis of the Technical Data Drawings. If departures from the technical data drawings are subsequently deemed necessary by the Contractor, details of such departures and the reasons thereof shall be submitted in writing to the COR for approval before the initiation of work.
6. Packaging: The Contractor shall organize the submissions according to the following packaging requirements.
   a. Binders: For each manual, provide heavy duty, commercial quality, durable three (3) ring vinyl covered loose leaf binders, sized to receive 8.5 x 11 in paper, and appropriate capacity to accommodate the contents. Provide a clear plastic sleeve on the spine to hold labels describing the contents. Provide pockets in the covers to receive folded sheets.
      1) Where two (2) or more binders are necessary to accommodate data; correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-

referencing other binders where necessary to provide essential information for communication of proper operation and/or maintenance of the component or system.

2) Identify each binder on the front and spine with printed binder title, Project title or name, and subject matter covered. Indicate the volume number if applicable.

b. Dividers: Provide heavy paper dividers with celluloid tabs for each Section. Mark each tab to indicate contents.

c. Protective Plastic Jackets: Provide protective transparent plastic jackets designed to enclose diagnostic software for computerized electronic equipment.

d. Text Material: Where written material is required as part of the manual use the manufacturer's standard printed material, or if not available, specially prepared data, neatly typewritten on 8.5 inches by 11 inches, 20-pound, white bond paper.

e. Drawings: Where drawings and/or diagrams are required as part of the manual, provide reinforced punched binder tabs on the drawings and bind them with the text.

1) Where oversized drawings are necessary, fold the drawings to the same size as the text pages and use as a foldout.

2) If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in the front or rear pocket of the binder. Insert a type written page indicating the drawing title, description of contents and drawing location at the appropriate location of the manual.

3) Drawings shall be sized to ensure details and text is of legible size. Text shall be no less than 1/16” tall.

f. Manual Content: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

1) Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test and furnish the remaining manuals prior to contract completion.

2) Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract 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 system or equipment.
3) 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 and maintenance instructions.
   e) Safety precautions.
   f) Diagrams and illustrations.
   g) Testing methods.
   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 parts, and name of servicing organization.
   j) Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.

g. Binder Organization: Organize each manual into separate sections for each piece of related equipment. At a minimum, each manual shall contain a title page, table of contents, copies of Product Data supplemented by drawings and written text, and copies of each warranty, bond, certifications, and service Contract issued. Refer to Group I through V Technical Data Package Submittal requirements for required section content.

h. Title Page: Provide a title page as the first sheet of each manual to include the following information; project name and

address, subject matter covered by the manual, name and address of the Project, date of the submittal, name, address, and telephone number of the Contractor, and cross references to related systems in other operating and/or maintenance manuals.

i. Table of Contents: After the title page, include a type written table of contents for each volume, arranged systematically according to the Project Manual format. Provide a list of each product included, identified by product name or other appropriate identifying symbols and indexed to the content of the volume. Where more than one (1) volume is required to hold data for a particular system, provide a comprehensive table of contents for all volumes in each volume of the set.

j. General Information Section: Provide a general information section immediately following the table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the installer and maintenance Contractor. In addition, list a local source for replacement parts and equipment.

k. Drawings: Provide specially prepared drawings where necessary to supplement the manufacturers printed data to illustrate the relationship between components of equipment or systems or provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation.

l. Manufacturer’s Data: Where manufacturer's standard printed data is included in the manuals, include only those sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where more than one (1) item in tabular format is included, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation and delete references to information which is not applicable.

m. Where manufacturer's standard printed data is not available, and the information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement the data included in the manual,

prepare written text to provide the necessary information. Organize the text in a consistent format under a separate heading for different procedures. Where necessary, provide a logical sequence of instruction for each operating or maintenance procedure. Where similar or more than one product is listed on the submittal the Contractor shall differentiate by highlighting the specific product to be utilized.

n. Calculations: Provide a section for circuit and panel calculations.

o. Loading Sheets: Provide a section for DGP Loading Sheets.

p. Certifications: Provide section for Contractor's manufacturer certifications.

7. Contractor Review: Review submittals prior to transmittal. Determine and verify field measurements and field construction criteria. Verify manufacturer's catalog numbers and conformance of submittal with requirements of contract documents. Return non-conforming or incomplete submittals with requirements of the work and contract documents. Apply Contractor's stamp with signature certifying the review and verification of products occurred, and the field dimensions, adjacent construction, and coordination of information is in accordance with the requirements of the contract documents.

8. Resubmission: Revise and resubmit submittals as required within 15 calendar days of return of submittal. Make resubmissions under procedures specified for initial submittals. Identify all changes made since previous submittal.

9. Product Data: Within 15 calendar days after execution of the contract, the Contractor shall submit for approval a complete list of all of major products proposed for use. The data shall include name of manufacturer, trade name, model number, the associated contract document section number, paragraph number, and the referenced standards for each listed product.

F. Group 1 Technical Data Package: Group I Technical Data Package shall be one submittal consisting of the following content and organization. Refer to VA Special Conditions Document for drawing format and content requirements. The data package shall include the following:

1. Section I - Drawings:

a. General – Drawings shall conform to VA CAD Standards Guide. All text associated with security details shall be 1/8” tall and meet VA text standard for AutoCAD™ drawings.
b. Cover Sheet – Cover sheet shall consist of Project Title and Address, Project Number, Area and Vicinity Maps.
c. General Information Sheets – General Information Sheets shall consist of General Notes, Abbreviations, Symbols, Wire and Cable Schedule, Project Phasing, and Sheet Index.
d. Floor Plans – Floor plans shall be produced from the Architectural backgrounds issued in the Construction Documents. The contractor shall receive floor plans from the prime A/E to develop these drawing sets. Security devices shall be placed on drawings in scale. All text associated with security details shall be 1/8” tall and meet VA text standard for AutoCAD™ drawings. Floor plans shall identify the following:
   1) Security devices by symbol,
   2) The associated device point number (derived from the loading sheets),
   3) Wire & cable types and counts
   4) Conduit sizing and routing
   5) Conduit riser systems
   6) Device and area detail call outs
e. Architectural details – Architectural details shall be produced for each device mounting type (door details for EECS and IDS, Intrusion Detection system (motion sensor, vibration, microwave Motion Sensor and Camera mounting,
f. Riser Diagrams – Contractor shall provide a riser diagram indicating riser architecture and distribution of the SMS throughout the facility (or area in scope).
g. Block Diagrams – Contractor shall provide a block diagram for the entire system architecture and interconnections with SMS subsystems. Block diagram shall identify SMS subsystem (e.g., electronic entry control, intrusion detection, closed circuit television, intercom, and other associated subsystems) integration; and data transmission and media conversion methodologies.

h. Interconnection Diagrams – Contractor shall provide interconnection diagram for each sensor, and device component. Interconnection diagram shall identify termination locations, standard wire detail to include termination schedule. Diagram shall also identify interfaces to other systems such as elevator control, fire alarm systems, and security management systems.

i. Electrical Panel Schedule – Electrical Panel Details shall be provided for all SMS systems electrical power circuits. Panel details shall be provided identifying panel type (Standard, Emergency Power, Emergency/Uninterrupted Power Source, and Uninterrupted Power Source Only), panel location, circuit number, and circuit amperage rating.

j. Door Schedule – A door schedule shall be developed for each door equipped with electronic security components. At a minimum, the door schedule shall be coordinated with Division 08 work and include the following information:

1) Item Number
2) Door Number (Derived from A/E Drawings)
3) Floor Plan Sheet Number
4) Standard Detail Number
5) Door Description (Derived from Loading Sheets)
6) Data Gathering Panel Input Number
7) Door Position or Monitoring Device Type & Model Number
8) Lock Type, Model Number & Power Input/Draw (standby/active)
9) Card Reader Type & Model Number
10) Shunting Device Type & Model Number
11) Sounder Type & Model Number
12) Manufacturer
13) Misc. devices as required
    a) Delayed Egress Type & Model Number
    b) Intercom
    c) Camera
    d) Electric Transfer Hinge
    e) Electric Pass-through device
14) Remarks column indicating special notes or door configurations

2. Camera Schedule - A camera schedule shall be developed for each camera. Contractors shall coordinate with the COR to determine

camera starting numbers and naming conventions. All drawings shall identify wire and cable standardization methodology. Color coding of all wiring conductors and jackets is required and shall be communicated consistently throughout the drawings package submittal. At a minimum, the camera schedule shall include the following information:

a. Item Number
b. Camera Number
c. Naming Conventions
d. Description of Camera Coverage
e. Camera Location
f. Floor Plan Sheet Number
g. Camera Type
h. Mounting Type
i. Standard Detail Reference
j. Power Input & Draw
k. Power Panel Location
l. Remarks Column for Camera

3. Section II - Data Gathering Panel Documentation Package
   a. Contractor shall provide Data Gathering Panel (DGP) input and output documentation packages for review at the Shop Drawing submittal stage and also with the as-built documentation package. The documentation packages shall be provided in both printed and magnetic form at both review stages.
   b. The Contractor shall provide loading sheet documentation package for the associated DGP, including input and output boards for all field panels associated with the project. Documentation shall be provided in current version Microsoft Excel spreadsheets following the format currently utilized by VA. A separate spreadsheet file shall be generated for each DGP and associated field panels.
   c. The spreadsheet names shall follow a sequence that shall display the spreadsheets in numerical order according to the DGP system number. The spreadsheet shall include the prefix in the file name that uniquely identifies the project site. The spreadsheet shall detail all connected items such as card readers, alarm inputs, and relay output connections. The spreadsheet shall

include an individual section (row) for each panel input, output and card reader. The spreadsheet shall automatically calculate the system numbers for card readers, inputs, and outputs based upon data entered in initialization fields.

All entries must be verified against the field devices. Copies of the floor plans shall be forwarded under separate cover.

d. The DGP spreadsheet shall include an entry section for the following information:
   1) DGP number
   2) First Reader Number
   3) First Monitor Point Number
   4) First Relay Number
   5) DGP, input or output Location
   6) DGP Chain Number
   7) DGP Cabinet Tamper Input Number
   8) DGP Power Fail Input Number
   9) Number of Monitor Points Reserved for Expansion Boards
   10) Number of Control Points (Relays) Reserved for Expansion Boards
e. The DGP, input module and output module spreadsheets shall automatically calculate the following information based upon the associated entries in the above fields:
   1) System Numbers for Card Readers
   2) System Numbers for Monitor Point Inputs
   3) System Numbers for Control Points (Relays)
   4) Next DGP or input module First Monitor Point Number
   5) Next DGP or output module First Control Point Number
f. The DGP spreadsheet shall provide the following information for each card reader:
   1) DGP Reader Number
   2) System Reader Number
   3) Cable ID Number
   4) Description Field (Room Number)
   5) Description Field (Device Type i.e.: In Reader, Out Reader)
   6) Description Field
   7) DGP Input Location
   8) Date Test
   9) Date Passed

10) Cable Type

11) Camera Numbers (of cameras viewing the reader location)

g. The DGP and input module spreadsheet shall provide the following information for each monitor point (alarm input).

1) DGP Monitor Point Input Number

2) System Monitor Point Number

3) Cable ID Number

4) Description Field (Room Number)

5) Description Field (Device Type i.e.: Door Contact, Motion Detector)

6) DGP or input module Input Location

7) Date Test

8) Date Passed

9) Cable Type

10) Camera Numbers (of associated alarm event preset call-ups)

h. The DGP and output module spreadsheet shall provide the following information for each control point (output relay).

1) DGP Control Point (Relay) Number

2) System (Control Point) Number

3) Cable ID Number

4) Description Field (Room Number)

5) Description Field (Device: Lock Control, Local Sounder)

6) Description Field

7) DGP or OUTPUT MODULE Output Location

8) Date Test

9) Date Passed Cable Type

10) Camera Number (of associated alarm event preset call-ups)

i. The DGP, input module and output module spreadsheet shall include the following information or directions in the header and footer:

1) Header

a) DGP Input and Output Worksheet

b) Enter Beginning Reader, Input, and Output Starting Numbers and Sheet Will Automatically Calculate the Remaining System Numbers.

2) Footer

a) File Name

b) Date Printed

c) Page Number

4. Section III - Construction Mock-up: In areas with exposed EMT/Conduit Raceways, contractor shall conceal raceway as much as practical and unobtrusively. In addition, historic significance must be considered to determine installation means and methods for approval by the owner.
5. Section IV - Manufacturers' Data: The data package shall include manufacturers' data for all materials and equipment, including sensors, local processors and console equipment provided under this specification.
6. Section V - System Description and Analysis: The data package shall include system descriptions, analysis, and calculations used in sizing equipment required by these specifications. Descriptions and calculations shall show how the equipment will operate as a system to meet the performance requirements of this specification. The data package shall include the following:
   a. Central processor memory size; communication speed and protocol description; rigid disk system size and configuration; flexible disk system size and configuration; back-up media size and configuration; alarm response time calculations; command response time calculations; start-up operations; expansion capability and method of implementation; sample copy of each report specified; and color photographs representative of typical graphics.
   b. Software Data: The data package shall consist of descriptions of the operation and capability of the system, and application software as specified.
   c. Overall System Reliability Calculations: The data package shall include all manufacturers' reliability data and calculations required to show compliance with the specified reliability.
7. Section VI – Certifications & References: All specified manufacturer's certifications shall be included with the data package. Contractor shall provide Project references as outlined in Paragraph 1.4 "Quality Assurance".

G. Group II Technical Data Package
1. The Contractor shall prepare a report of "Current Site Conditions" and submit a report to the COR documenting changes to the site, particularly those conditions that affect performance of the system

to be installed. The Contractor shall provide specification sheets, or written functional requirements to support the findings, and a cost estimate to correct those site changes or conditions which affect the installation of the system or its performance. The Contractor shall not correct any deficiency without written permission from the COR.

2. System Configuration and Functionality: The contractor shall provide the results of the meeting with VA to develop system requirements and functionality including :
   a. Baseline configuration
   b. Access levels
   c. Schedules (intrusion detection, physical access control, holidays, etc.)
   d. Badge database
   e. System monitoring and reporting (unit level and central control)
   f. Naming conventions and descriptors
   g. Group III Technical Data Package
3. Development of Test Procedures: The Contractor will prepare performance test procedures for the system testing. The test procedures shall follow the format of the VA Testing procedures and be customized to the contract requirements. The Contractor will deliver the test procedures to the COR for approval at least 60 calendar days prior to the requested test date.

H. Group IV Technical Data Package
1. Performance Verification Test
   a. Based on the successful completion of the pre-delivery test, the Contractor shall finalize the test procedures and report forms for the performance verification test (PVT) and the endurance test. The PVT shall follow the format, layout and content of the pre-delivery test. The Contractor shall deliver the PVT and endurance test procedures to the COR for approval. The Contractor may schedule the PVT after receiving written approval of the test procedures. The Contractor shall deliver the final PVT and endurance test reports within 14 calendar days from completion of the tests. Refer to Part 3 of this section for System Testing and Acceptance requirements.
2. Training Documentation

a. New Facilities and Major Renovations: Familiarization training shall be provided for new equipment or systems. Training can include site familiarization training for VA technicians and administrative personnel. Training shall include general information on new system layout including closet locations, turnover of the completed system including all documentation, including manuals, software, key systems, and full system administration rights. Lesson plans and training manuals training shall be oriented to type of training to be provided.

3. System Configuration and Data Entry:
   a. The contractor is responsible for providing all system configuration and data entry for the SMS and subsystems (e.g., video matrix switch, intercom, digital video recorders, network video recorders). All data entry shall be performed per VA standards & guidelines. The Contractor is responsible for participating in all meetings with the client to compile the information needed for data entry. These meetings shall be established at the beginning of the project and incorporated in to the project schedule as a milestone task. The contractor shall be responsible for all data collection, data entry, and system configuration. The contractor shall collect, enter, & program and/or configure the following components:
      1) Physical Access control system components,
      2) All intrusion detection system components,
      3) Video surveillance, control and recording systems,
      4) Intercom systems components,
      5) All other security subsystems shown in the contract documents.
   b. The Contractor is responsible for compiling the card access database for the VA employees, including programming reader configurations, access shifts, schedules, exceptions, card classes and card enrollment databases.
   c. Refer to Part 3 for system programming requirements and planning guidelines.
4. Graphics: Based on CAD as-built drawings developed for the construction project, create all map sets showing locations of all alarms and field devices. Graphical maps of all alarm points installed under this contract including perimeter and exterior alarm

points shall be delivered with the system. The Contractor shall create and install all graphics needed to make the system operational. The Contractor shall utilize data from the contract documents, Contractor's field surveys, and all other pertinent information in the Contractor's possession to complete the graphics. The Contractor shall identify and request from the COR, any additional data needed to provide a complete graphics package. Graphics shall have sufficient level of detail for the system operator to assess the alarm. The Contractor shall supply hard copy, color examples at least 203.2 x 254 mm (8 x 10 in) of each type of graphic to be used for the completed Security system. The graphics examples shall be delivered to the COR for review and approval at least 90 calendar days prior to the scheduled date the Contractor requires them.

I. Group V Technical Data Package: Final copies of the manuals shall be delivered to the COR as part of the acceptance test. The draft copy used during site testing shall be updated with any changes required prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each sub-contractor installing equipment or systems, as well as the nearest service representatives for each item of equipment for each system. The manuals shall include a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the endurance test shall include all modifications made during installation, checkout, and acceptance. Six (6) hard-copies and one (1) soft copy on CD of each item listed below shall be delivered as a part of final systems acceptance.

1. Functional Design Manual: The functional design manual shall identify the operational requirements for the entire system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included for all system operating modes. Manufacturer developed literature may be used; however, shall be produced to match the project requirements.

2. Equipment Manual: A manual describing all equipment furnished including:
   a. General description and specifications; installation and checkout procedures; equipment electrical schematics and layout drawings; system schematics and layout drawings; alignment and calibration procedures; manufacturer’s repair list indicating sources of supply; and interface definition.
3. Software Manual: The software manual shall describe the functions of all software and include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
   a. Definition of terms and functions; use of system and applications software; procedures for system initialization, start-up, and shutdown; alarm reports; reports generation, database format and data entry requirements; directory of all disk files; and description of all communications protocols including data formats, command characters, and a sample of each type of data transfer.
4. Operator’s Manual: The operator’s manual shall fully explain all procedures and instructions for the operation of the system, including:
   a. Computers and peripherals; system start-up and shutdown procedures; use of system, command, and applications software; recovery and restart procedures; graphic alarm presentation; use of report generator and generation of reports; data entry; operator commands’ alarm messages, and printing formats; and system access requirements.
5. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, recommend schedules, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
6. Spare Parts & Components Data: At the conclusion of the Contractor's work, the Contractor shall submit to the COR a complete list of the manufacturer's recommended spare parts and components required to satisfactorily maintain and service the systems, as well as unit pricing for those parts and components.

7. Operation, Maintenance & Service Manuals: The Contractor shall provide two (2) complete sets of operating and maintenance manuals in the form of an instructional manual for use by the VA Security Guard Force personnel. The manuals shall be organized into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder. If multiple volumes are required, each volume shall be fully indexed and coordinated.
8. Equipment and Systems Maintenance Manual: The Contractor shall provide the following descriptive information for each piece of equipment, operating system, and electronic system:
   a. Equipment and/or system function.
   b. Operating characteristics.
   c. Limiting conditions.
   d. Performance curves.
   e. Engineering data and test.
   f. Complete nomenclature and number of replacement parts.
   g. Provide operating and maintenance instructions including assembly drawings and diagrams required for maintenance and a list of items recommended to stock as spare parts.
   h. Provide information detailing essential maintenance procedures including the following: routine operations, troubleshooting guide, disassembly, repair and re-assembly, alignment, adjusting, and checking.
   i. Provide information on equipment and system operating procedures, including the following; start-up procedures, routine and normal operating instructions, regulation and control procedures, instructions on stopping, shut-down and emergency instructions, required sequences for electric and electronic systems, and special operating instructions.
   j. Manufacturer equipment and systems maintenance manuals are permissible.
9. Project Redlines: During construction, the Contractor shall maintain an up-to-date set of construction redlines detailing current location and configuration of the project components. The redline documents shall be marked with the words 'Master Redlines' on the cover sheet and be maintained by the Contractor in the project office. The Contractor will provide access to redline

documents anytime during the project for review and inspection by the COR or authorized Office of Protection Services representative. Master redlines shall be neatly maintained throughout the project and secured under lock and key in the contractor's onsite project office. Any project component or assembly that is not installed in strict accordance with the drawings shall be so noted on the drawings. Prior to producing Record Construction Documents, the contractor will submit the Master Redline document to the COR for review and approval of all changes or modifications to the documents. Each sheet shall have COR initials indicating authorization to produce "As Built" documents. Field drawings shall be used for data gathering & field changes. These changes shall be made to the master redline documents daily. Field drawings shall not be considered "master redlines".

10. Record Specifications: The Contractor shall maintain one (1) copy of the Project Specifications, including addenda and modifications issued, for Project Record Documents. The Contractor shall mark the Specifications to indicate the actual installation where the installation varies substantially from that indicated in the Contract Specifications and modifications issued. (Note related Project Record Drawing information where applicable). The Contractor shall pay particular attention to substitutions, selection of product options, and information on concealed installations that would be difficult to identify or measure and record later. Upon completion of the mark ups, the Contractor shall submit record Specifications to the COR. As with master relines, Contractor shall maintain record specifications for COR review and inspection at any time.
11. Record Product Data: The Contractor shall maintain one (1) copy of each Product Data submittal for Project Record Document purposes. The Data shall be marked to indicate the actual product installed where the installation varies substantially from that indicated in the Product Data submitted. Significant changes in the product delivered to the site and changes in manufacturer's instructions and recommendations for installation shall be included. Particular attention shall be given to information on concealed products and installations that cannot be readily identified or recorded later. Note related Change Orders and mark up of Record Construction

Documents, where applicable. Upon completion of mark up, submit a complete set of Record Product Data to the COR.

12. Miscellaneous Records: The Contractor shall maintain one (1) copy of miscellaneous records for Project Record Document purposes. Refer to other Specifications for miscellaneous record-keeping requirements and submittals concerning various construction activities. Before substantial completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Categories of requirements resulting in miscellaneous records include a minimum of the following:
    a. Certificates received instead of labels on bulk products.
    b. Testing and qualification of tradesmen. ("Contractor's Qualifications")
    c. Documented qualification of installation firms.
    d. Load and performance testing.
    e. Inspections and certifications.
    f. Final inspection and correction procedures.
    g. Project schedule
13. Record Construction Documents (Record As-Built)
    a. Upon project completion, the contractor shall submit the project master redlines to the COR prior to development of Record construction documents. The COR shall be given a minimum of a thirty (30) day review period to determine the adequacy of the master redlines. If the master redlines are found suitable by the COR, the COR will initial and date each sheet and turn redlines over to the contractor for as built development.
    b. The Contractor shall provide the COR a complete set of "as-built" drawings and original master redlined marked "as-built" blue-line in the latest version of AutoCAD drawings unlocked on CD or DVD. The as-built drawing shall include security device number, security closet connection location, data gathering panel number, and input or output number as applicable. All corrective notations made by the Contractor shall be legible when submitted to the COR. If, in the opinion of the COR, any redlined notation is not legible, it shall be returned to the Contractor for re-submission at no extra cost to the Owner. The Contractor shall organize the Record Drawing sheets into manageable sets bound

with durable paper cover sheets with suitable titles, dates, and other identifications printed on the cover. The submitted as built shall be in editable formats and the ownership of the drawings shall be fully relinquished to the owner.

c. Where feasible, the individual or entity that obtained record data, whether the individual or entity is the installer, sub-contractor, or similar entity, is required to prepare the mark up on Record Drawings. Accurately record the information in a comprehensive drawing technique. Record the data when possible after it has been obtained. For concealed installations, record and check the mark up before concealment. At the time of substantial completion, submit the Record Construction Documents to the COR. The Contractor shall organize into bound and labeled sets for the COR's continued usage. Provide device, conduit, and cable lengths on the conduit drawings. Exact in-field conduit placement/routings shall be shown. All conduits shall be illustrated in their entire length from termination in security closets; no arrowed conduit runs shall be shown. Pull box and junction box sizes are to be shown if larger than 100mm (4 inch).

J. FIPS 201 Compliance Certificates

1. Provide Certificates for all software components and device types utilizing credential verification. Provide certificates for:

a. Fingerprint Capture Station

b. Card Readers

c. Facial Image Capturing Camera

d. PIV Middelware

e. Template Matcher

f. Electromagnetically Opaque Sleeve

g. Certificate Management

1) CAK Authentication System

2) PIV Authentication System

3) Certificate Validator

4) Cryptographic Module

h. <list devices and software>

K. Approvals will be based on complete submission of manuals together with shop drawings.

L. After approval and prior to installation, furnish the COR with one sample of each of the following:
   1. A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
   2. Each type of conduit and pathway coupling, bushing and termination fitting.
   3. Conduit hangers, clamps and supports.
   4. Duct sealing compound.

M. 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.

1.7 APPLICABLE PUBLICATIONS

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

B. American National Standards Institute (ANSI)/ International Code Council (ICC):

   A117.1.....Standard on Accessible and Usable Buildings and Facilities

C. American National Standards Institute (ANSI)/ Security Industry Association (SIA):

   AC-03.....Access Control: Access Control Guideline Dye Sublimation Printing Practices for PVC Access Control Cards

   CP-01-00.....Control Panel Standard-Features for False Alarm Reduction

   PIR-01-00.....Passive Infrared Motion Detector Standard - Features for Enhancing False Alarm Immunity

   TVAC-01.....CCTV to Access Control Standard - Message Set for System Integration

D. American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA):

   330-09.....Electrical Performance Standards for CCTV Cameras

375A-76.....Electrical Performance Standards for CCTV Monitors

E. American National Standards Institute (ANSI):

ANSI S3.2-99.....Method for measuring the Intelligibility of Speech over Communications Systems

F. American Society for Testing and Materials (ASTM)

B1-07.....Standard Specification for Hard-Drawn Copper Wire

B3-07.....Standard Specification for Soft or Annealed Copper Wire

B8-04.....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C1238-97 (R03).....Standard Guide for Installation of Walk-Through Metal Detectors

D2301-04.....Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape

G. Architectural Barriers Act (ABA), 1968

H. Department of Justice: American Disability Act (ADA)

28 CFR Part 36-2010 ADA Standards for Accessible Design

I. Department of Veterans Affairs:

1. VHA National CAD Standard Application Guide, 2006

J. VA BIM Guide, V1.0 10

K. Federal Communications Commission (FCC):

L. (47 CFR 15) Part 15 Limitations on the Use of Wireless Equipment/Systems

M. Federal Information Processing Standards (FIPS):

FIPS-201-1.....Personal Identity Verification (PIV) of Federal Employees and Contractors

N. Federal Specifications (Fed. Spec.):

A-A-59544-08.....Cable and Wire, Electrical (Power, Fixed Installation)

O. Government Accountability Office (GAO):

GAO-03-8-02.....Security Responsibilities for Federally Owned and Leased Facilities

P. Homeland Security Presidential Directive (HSPD):

HSPD-12.....Policy for a Common Identification Standard for Federal Employees and Contractors

Q. Institute of Electrical and Electronics Engineers (IEEE):

81-1983.....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

802.3af-08.....Power over Ethernet Standard

802.3at-09 .....Power over Ethernet (PoE) Plus Standard

C2-07.....National Electrical Safety Code

C62.41-02.....IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

C95.1-05.....Standards for Safety Levels with Respect to Human Exposure in Radio Frequency Electromagnetic Fields

R. International Organization for Standardization (ISO):

7810.....Identification cards – Physical characteristics

7811.....Physical Characteristics for Magnetic Stripe Cards

7816-1.....Identification cards - Integrated circuit(s) cards with contacts - Part 1: Physical characteristics

7816-2.....Identification cards - Integrated circuit cards - Part 2: Cards with contacts -Dimensions and location of the contacts

7816-3.....Identification cards - Integrated circuit cards - Part 3: Cards with contacts - Electrical interface and transmission protocols

7816-4.....Identification cards - Integrated circuit cards - Part 11: Personal verification through biometric methods

7816-10.....Identification cards - Integrated circuit cards - Part 4: Organization, security and commands for interchange

14443.....Identification cards - Contactless integrated circuit cards; Contactless Proximity Cards Operating at 13.56 MHz in up to 5 inches distance

15693.....Identification cards -- Contactless integrated circuit cards - Vicinity cards; Contactless Vicinity Cards Operating at 13.56 MHz in up to 50 inches distance

19794.....Information technology - Biometric data interchange formats

S. National Electrical Contractors Association

303-2005.....Installing Closed Circuit Television (CCTV) Systems

T. National Electrical Manufactures Association (NEMA):

250-08.....Enclosures for Electrical Equipment (1000 Volts Maximum)

TC-3-04.....PVC Fittings for Use with Rigid PVC Conduit and Tubing

FB1-07.....Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

U. National Fire Protection Association (NFPA):

70-2018..... National Electrical Code (NEC)

731-2017.....Standards for the Installation of Electric Premises Security Systems

99-2018.....Health Care Facilities

V. National Institute of Justice (NIJ)

0601.02-03.....Standards for Walk-Through Metal Detectors for use in Weapons Detection

0602.02-03.....Hand-Held Metal Detectors for Use in Concealed Weapon and Contraband Detection

W. National Institute of Standards and Technology (NIST):

IR 6887 V2.1.....Government Smart Card Interoperability Specification (GSC-IS)

Special Pub 800-37...Guide for Applying the Risk Management Framework to Federal Information Systems

Special Pub 800-63...Electronic Authentication Guideline

Special Pub 800-73-3.Interfaces for Personal Identity Verification (4 Parts)

.....Pt. 1- End Point PIV Card Application Namespace, Data Model & Representation

.....Pt. 2- PIV Card Application Card Command Interface

.....Pt. 3- PIV Client Application Programming Interface

.....Pt. 4- The PIV Transitional Interfaces & Data Model Specification

Special Pub 800-76-1.Biometric Data Specification for Personal Identity Verification

Special Pub 800-78-2.Cryptographic Algorithms and Key Sizes for Personal Identity Verification

Special Pub 800-79-1.Guidelines for the Accreditation of Personal Identity Verification Card Issuers

Special Pub 800-85B-1 DRAFTPIV Data Model Test Guidelines

Special Pub 800-85A-2 PIV Card Application and Middleware Interface Test Guidelines (SP 800-73-3 compliance)

Special Pub 800-96...PIV Card Reader Interoperability Guidelines

Special Pub 800-104A.Scheme for PIV Visual Card Topography

X. Occupational and Safety Health Administration (OSHA):

29 CFR 1910.97.....Nonionizing radiation

Y. Section 508 of the Rehabilitation Act of 1973

Z. Security Industry Association (SIA):

AG-01 .....Security CAD Symbols Standards

AA. Underwriters Laboratories, Inc. (UL):

1-05.....Flexible Metal Conduit

5-04.....Surface Metal Raceway and Fittings

6-07.....Rigid Metal Conduit

44-05.....Thermoset-Insulated Wires and Cables

50-07.....Enclosures for Electrical Equipment

83-08.....Thermoplastic-Insulated Wires and Cables

294-99.....The Standard of Safety for Access Control System Units

305-08.....Standard for Panic Hardware

360-09.....Liquid-Tight Flexible Steel Conduit

444-08.....Safety Communications Cables

464-09.....Audible Signal Appliances

467-07.....Electrical Grounding and Bonding Equipment

486A-03.....Wire Connectors and Soldering Lugs for Use with Copper Conductors

486C-04.....Splicing Wire Connectors

486D-05.....Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations

486E-00.....Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

493-07.....Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable

514A-04.....Metallic Outlet Boxes

514B-04.....Fittings for Cable and Conduit

51-05.....Schedule 40 and 80 Rigid PVC Conduit

609-96.....Local Burglar Alarm Units and Systems

634-07.....Standards for Connectors with Burglar-Alarm Systems

636-01.....Standard for Holdup Alarm Units and Systems

639-97.....Standard for Intrusion-Detection Units

651-05.....Schedule 40 and 80 Rigid PVC Conduit

651A-07.....Type EB and A Rigid PVC Conduit and HDPE Conduit

752-05.....Standard for Bullet-Resisting Equipment

797-07.....Electrical Metallic Tubing

827-08.....Central Station Alarm Services

1037-09.....Standard for Anti-theft Alarms and Devices

1635-10.....Digital Alarm Communicator System Units

1076-95.....Standards for Proprietary Burglar Alarm Units and Systems

1242-06.....Intermediate Metal Conduit

1479-03.....Fire Tests of Through-Penetration Fire Stops

1981-03.....Central Station Automation System

2058-05.....High Security Electronic Locks

60950.....Safety of Information Technology Equipment

60950-1.....Information Technology Equipment - Safety - Part 1: General Requirements

BB. Uniform Federal Accessibility Standards (UFAS) 1984

CC. United States Department of Commerce:

Special Pub 500-101 .Care and Handling of Computer Magnetic Storage Media

1.8 COORDINATION

A. Coordinate arrangement, mounting, and support of electronic safety and security equipment:
   1. To allow maximum 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 electronic safety and security items that are behind finished surfaces or otherwise concealed.

1.9 MAINTENANCE & SERVICE

A. General Requirements
   1. The Contractor shall provide all services required and equipment necessary to maintain the entire integrated electronic security system in an operational state as specified for a period of one (1) year after formal written acceptance of the system. The Contractor shall provide all necessary material required for performing scheduled adjustments or other non-scheduled work. Impacts on facility operations shall be minimized when performing scheduled adjustments or other non-scheduled work. See also General Project Requirements.

B. Description of Work
   1. The adjustment and repair of the security system includes all software updates, panel firmware, and the following new items computers equipment, communications transmission equipment and data transmission media (DTM), local processors, security system sensors,

physical access control equipment, facility interface, signal transmission equipment, and video equipment.

C. Personnel:

1. Service personnel shall be certified in the maintenance and repair of the selected type of equipment and qualified to accomplish all work promptly and satisfactorily. The COR shall be advised in writing of the name of the designated service representative, and of any change in personnel. The COR shall be provided copies of system manufacturer certification for the designated service representative.

D. Schedule of Work

1. The work shall be performed during regular working hours, Monday through Friday, excluding federal holidays.

E. System Inspections

1. These inspections shall include:
   a. The Contractor shall perform two (2) minor inspections at six (6) month intervals or more if required by the manufacturer, and two (2) major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
      1) Minor Inspections shall include visual checks and operational tests of all console equipment, peripheral equipment, local processors, sensors, electrical and mechanical controls, and adjustments on printers.
      2) Major Inspections shall include all work described for Minor Inspections and the following: clean all system equipment and local processors including interior and exterior surfaces; perform diagnostics on all equipment; operational tests of the CPU, switcher, peripheral equipment, recording devices, monitors, picture quality from each camera; check, walk test, and calibrate each sensor; run all system software diagnostics and correct all problems; and resolve any previous outstanding problems.

F. Emergency Service

1. The owner shall initiate service calls whenever the system is not functioning properly. The Contractor shall provide the Owner with an emergency service center telephone number. The emergency service

center shall be staffed 24 hours a day, 365 days a year. The Owner shall have sole authority for determining catastrophic and non-catastrophic system failures within parameters stated in General Project Requirements.

a. For catastrophic system failures, the Contractor shall provide same day four (4) hour service response with a defect correction time not to exceed eight (8) hours from [notification] [arrival on site]. Catastrophic system failures are defined as any system failure that the Owner determines will place the facility(s) at increased risk.

b. For non-catastrophic failures, the Contractor within eight (8) hours with a defect correction time not to exceed 24 hours from notification.

G. Operation

1. Performance of scheduled adjustments and repair shall verify operation of the system as demonstrated by the applicable portions of the performance verification test.

H. Records & Logs

1. The Contractor shall maintain records and logs of each task and organize cumulative records for each component and for the complete system chronologically. A continuous log shall be submitted for all devices. The log shall contain all initial settings, calibration, repair, and programming data. Complete logs shall be maintained and available for inspection on site, demonstrating planned and systematic adjustments and repairs have been accomplished for the system.

I. Work Request

1. The Contractor shall separately record each service call request, as received. The record shall include the serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing the action taken, the amount and nature of the materials used, and the date and time of commencement and completion. The Contractor shall deliver a record of the work performed within five (5) working days after the work was completed.

J. System Modifications

1. The Contractor shall make any recommendations for system modification in writing to the COR. No system modifications, including operating parameters and control settings, shall be made without prior written approval from the COR. Any modifications made to the system shall be incorporated into the operation and maintenance manuals and other documentation affected.

K. Software

1. The Contractor shall provide all software updates when approved by the Owner from the manufacturer during the installation and 12-month warranty period and verify operation of the system. These updates shall be accomplished in a timely manner, fully coordinated with the system operators, and incorporated into the operations and maintenance manuals and software documentation. There shall be at least one (1) scheduled update near the end of the first year's warranty period, at which time the Contractor shall install and validate the latest released version of the Manufacturer's software. All software changes shall be recorded in a log maintained in the unit control room. An electronic copy of the software update shall be maintained within the log. At a minimum, the contractor shall provide a description of the modification, when the modification occurred, and name and contact information of the individual performing the modification. The log shall be maintained in a white 3 ring binder and the cover marked "SOFTWARE CHANGE LOG".

1.10 MINIMUM REQUIREMENTS

A. References to industry and trade association standards and codes are minimum installation requirement standards.

B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.11 DELIVERY, STORAGE, & HANDLING

A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:

1. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required.

2. Damaged equipment shall be, as determined by the COR, placed in first class operating condition or be returned to the source of supply for repair or replacement.
3. 3. Painted surfaces shall be protected with factory installed removable heavy craft paper, sheet vinyl or equal.
4. 4. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

B. Central Station, Workstations, and Controllers:
1. Store in temperature and humidity controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 10 to 30 deg C (50 to 85 deg F), and not more than 80 percent relative humidity, non-condensing.
2. Open each container; verify contents against packing list, and file copy of packing list, complete with container identification for inclusion in operation and maintenance data.
3. Mark packing list with designations which have been assigned to materials and equipment for recording in the system labeling schedules generated by cable and asset management system.
4. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.12 PROJECT CONDITIONS

A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
1. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of 2 to 50 deg C (36 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 1 enclosure.
2. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of -18 to 50 deg C (0 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 4X enclosures.

3. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of -34 to 50 deg C (-30 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 137 km/h (85 mph) and snow cover up to 610 mm (24 in) thick. NEMA 250, Type 4X enclosures.
4. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
5. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X enclosures.

B. Security Environment: Use vandal resistant enclosures in high-risk areas where equipment may be subject to damage.

C. Console: All console equipment shall, unless noted otherwise, be rated for continuous operation under ambient environmental conditions of 15.6 to 29.4 deg C (60 to 85 deg F) and a relative humidity of 20 to 80 percent.

1.13 EQUIPMENT AND MATERIALS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.

B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer.
2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final 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 shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified:

1. The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the COR a minimum of 15 working days prior to the manufacturers making the factory tests.
2. Four copies of certified test reports containing all test data shall be furnished to the COR prior to final inspection and not more than 90 days after completion of the tests.
3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

1.14 ELECTRICAL POWER

A. Electrical power of 120 Volts Alternating Current (VAC) shall be indicated on the Division 26 drawings. Additional locations requiring primary power required by the security system shall be shown as part of these contract documents. Primary power for the security system shall be configured to switch to emergency backup sources automatically if interrupted without degradation of any critical system function. Alarms shall not be generated as a result of power switching, however, an indication of power switching on (on-line source) shall be provided to the alarm monitor. The Security Contractor shall provide an interface (dry contact closure) between the PACS and the Uninterruptible Power Supply (UPS) system so the UPS trouble signals and main power fail appear on the PACS operator terminal as alarms.

B. Failure of any on-line battery shall be detected and reported as a fault condition. Battery backed-up power supplies shall be provided sized for [8] <insert hours> hours of operation at actual connected load. Requirements for additional power or locations shall be included with the contract to support equipment and systems offered. The following minimum requirements shall be provided for power sources and equipment.

1. Emergency Generator
   a. Report Printers: Unit Control Room
   b. Video Monitors: Unit Control Room
   c. Intercom Stations
   d. Radio System

e. Lights: Unit Control Room, Equipment Rooms, & Security Offices
f. Outlets: Security Outlets dedicated to security equipment racks or security enclosure assemblies.
g. Security Device Power Supplies (DGP, VASS, Card Access, Lock Power, etc.) powered from the security closets or remotely: various locations
h. Telephone/Radio Recording Equipment: Unit Control Room.
i. VASS Camera Power Supplies: Security Closets
j. VASS Pan/Tilt Units: Various Locations
k. VASS Outdoor Housing Heaters and Blowers: Various Sites
l. Intercom Master Control System
m. Fiber Optic Receivers/Transmitters
n. Security office Weapons Storage
o. Outlets that charge handheld radios

2. Uninterruptible Power Supply (UPS) on Emergency Power
   a. The following 120VAC circuits shall be provided by others. The Security Contractor shall coordinate exact locations with the Electrical Contractor:
      1) Security System Monitors and Keyboards: Control Room
      2) CPU: Control Equipment Room
      3) Communications equipment: Control Equipment Room and various sites.
      4) VASS Matrix Switcher: Control Equipment Room
      5) VASS: Control Equipment Room
      6) Digital Video Recorders, encoders & decoders: Control Room
      7) All equipment Room racked equipment.
      8) Network switches

1.15 TRANSIENT VOLTAGE SUPPRESSION, POWER SURGE SUPPLESION, & GROUNDING

A. Transient Voltage Surge Suppression: All cables and conductors extending beyond building façade, except fiber optic cables, which serve as communication, control, or signal lines shall be protected against Transient Voltage surges and have Transient Voltage Surge Suppression (TVSS) protection. The TVSS device shall be UL listed in accordance with Standard TIA 497B installed at each end. Lighting and surge suppression shall be a multi-strike variety and include a fault indicator. Protection shall be furnished at the equipment and additional triple solid state surge protectors rated for the

application on each wire line circuit shall be installed within 914.4 mm (3 ft) of the building cable entrance. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode to verify there is no interference.

1. A 10-microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
2. An 8-microsecond rise time by 20-microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.
3. Maximum series current: 2 AMPS. Provide units manufactured by Advanced Protection Technologies, model # TE/FA 10B or TE/FA 20B.
4. Operating Temperature and Humidity: -40 to 85 deg C (-40 to 185 deg F), 0 to 95 percent relative humidity.

B. Grounding and Surge Suppression:

1. The Security Contractor shall provide grounding and surge suppression to stabilize the voltage under normal operating conditions. To ensure the operation of over current devices, such as fuses, circuit breakers, and relays, underground-fault conditions.
2. Security Contractor shall engineer and provide proper grounding and surge suppression as required by local jurisdiction and prevailing codes and standards referenced in this document.
3. Principal grounding components and features. Include main grounding buses and grounding and bonding connections to service equipment.
4. Details of interconnection with other grounding systems. The lightning protection system shall be provided by the Security Contractor.
5. Locations and sizes of grounding conductors and grounding buses in electrical, data, and communication equipment rooms and closets.
6. AC power receptacles are not to be used as a ground reference point.
7. Any cable that is shielded shall require a ground in accordance with the best practices of the trade and manufactures installation instructions.
8. Protection should be provided at both ends of cabling.

1.16 COMPONENT ENCLOSURES

A. Construction of Enclosures

1. Consoles, power supply enclosures, detector control and terminal cabinets, control units, wiring gutters, and other component

housings, collectively referred to as enclosures, shall be so formed and assembled as to be sturdy and rigid.

2. Thickness of metal in-cast and sheet metal enclosures of all types shall not be less than those in Tables I and II, UL 611. Sheet steel used in fabrication of enclosures shall be not less than 14 gauge. Consoles shall be 16-gauge.
3. Doors and covers shall be flanged. Enclosures shall not have pre-punched knockouts. Where doors are mounted on hinges with exposed pins, the hinges shall be of the tight pin type or the ends of hinge pins shall be tack welded to prevent removal. Doors having a latch edge length of less than 609.6 mm (24 in) shall be provided with a single construction core. Where the latch edge of a hinged door is more than 609.6 mm (24 in) or more in length, the door shall be provided with a three-point latching device with construction core; or alternatively with two, one located near each end.
4. Any ventilator openings in enclosures and cabinets shall conform to the requirements of UL 611. Unless otherwise indicated, sheet metal enclosures shall be designed for wall mounting with tip holes slotted. Mounting holes shall be in positions that remain accessible when all major operating components are in place and the door is open but shall be in accessible when the door is closed.
5. Covers of pull and junction boxes provided to facilitate initial installation of the system shall be held in place by tamper proof Torx Center post security screws. Stenciled or painted labels shall be affixed to such boxes indicating they contain no connections. These labels shall not indicate the box is part of the Electronic Security System (ESS).

B. Consoles & Equipment Racks: All consoles and vertical equipment racks shall include a forced air-cooling system to be provided by others.

1. Vertical Equipment Racks:
   a. The forced air blowers shall be installed in the vented top of each cabinet and shall not reduce usable rack space.
   b. The forced air fan shall consist of one fan rated at 105 CFM per rack bay and noise level shall not exceed 55 decibels.
   c. Vertical equipment racks are to be provided with full sized clear plastic locking doors and vented top panels as shown on contract drawings.

2. Console racks:
   a. Forced air fans shall be installed in the top rear of each console bay. The forced air fan shall consist of one fan rated at 105 CFM mounted to a 133mm vented blank panel the noise level of each fan shall not exceed 55 decibels. The fans shall be installed so air is pulled from the bottom of the rack or cabinet and exhausted out the top.
   b. Console racks are to be provided with flush mounted hinged rear doors with recessed locking latch on the bottom and middle sections of the consoles. Provide code access to support wiring for devices located on the work surfaces.

C. Tamper Provisions and Tamper Switches:
   1. Enclosures, cabinets, housings, boxes and fittings or every product description having hinged doors or removable covers and which contain circuits, or the integrated security system and its power supplies shall be provided with cover operated, corrosion-resistant tamper switches.
   2. Tamper switches shall be arranged to initiate an alarm signal that will report to the monitoring station when the door or cover is moved. Tamper switches shall be mechanically mounted to maximize the defeat time when enclosure covers are opened or removed. It shall take longer than 1 second to depress or defeat the tamper switch after opening or removing the cover. The enclosure and tamper switch shall function together in such a manner as to prohibit direct line of sign to any internal component before the switch activates.
   3. Tamper switches shall be inaccessible until the switch is activated. Have mounting hardware concealed so the location of the switch cannot be observed from the exterior of the enclosure. Be connected to circuits which are under electrical supervision at all times, irrespective of the protection mode in which the circuit is operating. Be spring-loaded and held in the closed position by the door or cover and be wired so they break the circuit when the door cover is disturbed. Tamper circuits shall be adjustable type screw sets and shall be adjusted by the contractor to eliminate nuisance alarms associated with incorrectly mounted tamper device shall annunciate prior to the enclosure door opening (within 1/4”

tolerance. The tamper device or its components shall not be visible or accessing with common tools to bypass when the enclosure is in the secured mode.

4. The single gang junction boxes for the portrait alarming and pull boxes with less than 102 square mm will not require tamper switches.
5. All enclosures over 305 square mm shall be hinged with an enclosure lock.
6. Control Enclosures: Maintenance/Safety switches on control enclosures, which must be opened to make routing maintenance adjustments to the system and to service the power supplies, shall be push/pull-set automatic reset type.
7. Provide one (1) enclosure tamper switch for each 609 linear mm of enclosure lock side opening evenly spaced.
8. All security screws shall be Torx-Post Security Screws.
9. The contractor shall provide the owner with two (2) torx-post screwdrivers.

1.17 ELECTRONIC COMPONENTS

A. All electronic components of the system shall be of the solid-state type, mounted on printed circuit boards conforming to UL 796. Boards shall be plug-in, quick-disconnect type. Circuitry shall not be so densely placed as to impede maintenance. All power-dissipating components shall incorporate safety margins of not less than 25 percent with respect to dissipation ratings, maximum voltages, and current-carrying capacity.

1.18 SUBSTITUTE MATERIALS & EQUIPMENT

A. Where variations from the contract requirements are requested in accordance with the GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

B. In addition to this Section the Security Contractor shall also reference Section II, Products and associated divisions. The COR shall have final authority on the authorization or refusal of substitutions. If there are no proposed substitutions, a statement in writing from the Contractor shall be submitted to the COR stating same. In the

preparation of a list of substitutions, the following information shall be included, as a minimum:

1. Identity of the material or devices specified for which there is a proposed substitution.
2. Description of the segment of the specification where the material or devices are referenced.
3. Identity of the proposed substitute by manufacturer, brand name, catalog or model number and the manufacturer's product name.
4. A technical statement of all operational characteristic expressing equivalence to items to be substituted and comparison, feature-by-feature, between specification requirements and the material or devices called for in the specification; and Price differential.

C. Materials Not Listed: Furnish all necessary hardware, software, programming materials, and supporting equipment required to place the specified major subsystems in full operation. Note that some supporting equipment, materials, and hardware may not be described herein. Depending on the manufacturers selected by the COR, some equipment, materials and hardware may not be contained in either the Contract Documents or these written specifications but are required by the manufacturer for complete operation according to the intent of the design and these specifications. In such cases, the COR shall be given the opportunity to approve the additional equipment, hardware and materials that shall be fully identified in the bid and in the equipment list submittal. The COR shall be consulted in the event there is any question about which supporting equipment, materials, or hardware is intended to be included.

D. Response to Specification: The Contractor shall submit a point-by-point statement of compliance with each paragraph of the security specification. The statement of compliance shall list each paragraph by number and indicate "COMPLY" opposite the number for each paragraph where the Contractor fully complies with the specification. Where the proposed system cannot meet the requirements of the paragraph, and does not offer an equivalent solution, the offers shall indicate "DOES NOT COMPLY" opposite the paragraph number. Where the proposed system does not comply with the paragraph as written, but the bidder feels it will accomplish the intent of the paragraph in a manner different from that described, the offers shall indicate "COMPARABLE". The offers shall

include a statement fully describing the "comparable" method of satisfying the requirement. Where a full and concise description is not provided, the offered system shall be considered as not complying with the specification. Any submission that does not include a point-by-point statement of compliance, as described above, shall be disqualified. Submittals for products shall be in precise order with the product section of the specification. Submittals not in proper sequence will be rejected.

1.19 LIKE ITEMS

A. Where two or more items of equipment performing the same function are required, they shall be exact duplicates produced by one manufacturer. All equipment provided shall be complete, new, and free of any defects.

1.20 WARRANTY

A. The Contractor shall, as a condition precedent to the final payment, execute a written guarantee (warranty) to the COR certifying all contract requirements have been completed according to the final specifications. Contract drawings and the warranty of all materials and equipment furnished under this contract are to remain in satisfactory operating condition (ordinary wear and tear, abuse and causes beyond his control for this work accepted) for one (1) year from the date the Contactor received written notification of final acceptance from the COR. Demonstration and training shall be performed prior to system acceptance. All defects or damages due to faulty materials or workmanship shall be repaired or replaced without delay, to the COR's satisfaction, and at the Contractor's expense. The Contractor shall provide quarterly inspections during the warranty period. The contractor shall provide written documentation to the COR on conditions and findings of the system and device(s). In addition, the contractor shall provide written documentation of test results and stating what was done to correct any deficiencies. The first inspection shall occur 90 calendar days after the acceptance date. The last inspection shall occur 30 calendar days prior to the end of the warranty. The warranty period shall be extended until the last inspection and associated corrective actions are complete. When equipment and labor covered by the Contractor's warranty, or by a manufacturer's warranty, have been replaced or restored because of its failure during the warranty period, the warranty period for the

replaced or repaired equipment or restored work shall be reinstated for a period equal to the original warranty period, and commencing with the date of completion of the replacement or restoration work. In the event any manufacturer customarily provides a warranty period greater than one (1) year, the Contractor's warranty shall be for the same duration for that component.

1.21 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.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. All equipment associated within the Security Control Room, Security Console and Security Equipment Room shall be UL 827, UL 1981, and UL 60950 compliant and rated for continuous operation. Environmental conditions (i.e. temperature, humidity, wind, and seismic activity) shall be taken under consideration at each facility and site location prior to installation of the equipment.

B. All equipment shall operate on a 120 or 240 volts alternating current (VAC); 50 Hz or 60 Hz AC power system unless documented otherwise in subsequent sections listed within this specification. All equipment shall have a back-up source of power that will provide a minimum of 8 hours of run time in the event of a loss of primary power to the facility.

C. The system shall be designed, installed, and programmed in a manner that will allow for ease of operation, programming, servicing, maintenance, testing, and upgrading of the system.

D. All equipment and materials for the system will be compatible to ensure correct operation.

2.2 EQUIPMENT ITEMS

A. The Security Management System shall provide full interface with all components of the security subsystem as follows:

1. Shall allow for communication between the Physical Access Control System and Database Management and all subordinate work and monitoring stations, enrollment centers for badging and biometric

devices as part of the PACS, local annunciation centers, the electronic Security Management System (SMS), and all other VA redundant or backup command center or other workstations locations.

2. Shall provide automatic continuous communication with all systems that are monitored by the SMS, and shall automatically annunciate any communication failures or system alarms to the SMS operator providing identification of the system, nature of the alarm, and location of the alarm.
3. Controlling devices shall be utilized to interface the SMS with all field devices.

B. Wires and Cables:

1. Shall meet or exceed the manufactures recommendation for power and signals.
2. Shall be carried in an enclosed conduit system, utilizing electromagnetic tubing (EMT) to include the equivalent in flexible metal, rigid galvanized steel (RGS) to include the equivalent of liquid tight, polyvinylchloride (PVC) schedule 40 or 80.
3. All conduits will be sized and installed per the NEC. All security system signal and power cables that traverse or originate in a high security office space will contained in either EMT or RGS conduit.
4. All conduit, pull boxes, and junction boxes shall be marked with colored permanent tape or paint that will allow it to be distinguished from all other infrastructure conduit.
5. Conduit fills shall not exceed 50 percent unless otherwise documented.
6. A pull string shall be pulled along and provided with signal and power cables to assist in future installations.
7. At all locations where there is a wall penetration or core drilling is conducted to allow for conduit to be installed, fire stopping materials shall be applied to that area.
8. High voltage and signal cables shall not share the same conduit and shall be kept separate up to the point of connection. High voltage for the security subsystems shall be any cable or sets of cables carrying 30 VDC/VAC or higher.
9. For all equipment that is carrying digital data between the Security Control Room, Security Equipment Room, Security Console, or at a remote monitoring station, it shall not be less that 20 AWG and

stranded copper wire for each conductor. The cable or each individual conductor within the cable shall have a shield that provides 100% coverage. Cables with a single overall shield shall have a tinned copper shield drain wire.

2.3 FIBER OPTIC EQUIPMENT

A. 8 Channel Fiber Optic Transceivers (Video & PTZ Control)

1. The field-located and central-located fiber optic transceivers shall utilize wave division multiplexing to transmit and receive video and data pan-tilt-zoom control signals over two standard 50micron multimode fibers.
2. The units shall be capable of operating over a range of 2 km.
3. The units shall be NTSC color compatible.
4. The units shall support data rates up to 64 Kbps.
5. The units shall be surface or rack mountable.
6. The units shall be UL listed.
7. The units shall meet or exceed the following specifications:
   a. Video
      1) Input/Output: 1 volt pk-pk (75 ohms OR 100 OHMS)
      2) Input/Output Channels: 8
      3) Bandwidth: 10 Hz - 6.5 MHZ per channel
      4) Differential Gain: <2%
      5) Differential Phase: <0.7°
      6) Tilt: <1%
      7) Signal to Noise Ratio: 60 dB
   b. Data (Control)
      1) Data Channels: 2
      2) Data Format: RS-232, RS-422, 2 wire or 4 wire RS-485 with Tri-State Manchester Bi-Phase and Sensornet
      3) Data Rate: DC - 100 kbps (NRZ)
      4) Bit Error Rate: < 1 in 10-9 @ Maximum Optical Loss Budget
      5) Operating Mode: Simplex or Full-Duplex
      6) Wavelength: 1310/1550 nm, Multimode or Singlemode
      7) Optical Emitter: Laser Diode
      8) Number of Fibers: 1
   c. Connectors
      1) Optical: ST
      2) Power and Data: Terminal Block with Screw Clamps

3) Video: BNC (Gold Plated Center-Pin)

d. Electrical and Mechanical

1) Power: 12 VDC @ 500 mA (stand-alone)

2) Current Protection: Automatic Resettable Solid-State Current Limiters

e. Environmental

1) MTBF: > 100,000 hours

2) Operating Temp: -40 to 74 deg C (-40 to 165 deg F)

3) Storage Temp: -40 to 85 deg C (-40 to 185 deg F)

4) Relative Humidity: 0% to 95% (non-condensing)

B. Fiber Optic Transmitters: The central-located fiber optic transmitters shall utilize wave division multiplexing to transmit video and signals over standard 50 micron multimode fibers.

1. The units shall be capable of operating over a range of 4.8 km.
2. The units shall be NTSC color compatible.
3. The units shall support data rates up to 64 Kbps.
4. The units shall be surface or rack mountable.
5. The units shall be UL listed.
6. The units shall meet or exceed the following specifications:

a. Video

1) Input: 1 volt pk-pk (75 ohms)

2) Bandwidth: 5H2 - 10 MHZ

3) Differential Gain: <5%

4) Tilt: <1%

5) Signal-Noise: 60db

6) Wavelength: 850nm

7) Number of Fibers: 1

8) Operating Temp: -20 to 70 deg C (-4 to 158 deg F)

9) Connectors:

a) Power: Female plug with screw clamps

b) Video: BNC

c) Optical: ST

10) Power: 12 VDC

C. Fiber Optic Receivers: The field-located fiber optic receivers shall utilize wave division multiplexing to receive video signals over standard 50 micron multimode fiber.

1. The units shall be capable of operating over a range of 4.8 km.

2. The units shall be NTSC color compatible.
3. The units shall support data rates up to 64 Kbps.
4. The units shall be surface or rack mountable.
5. The units shall be UL listed.
6. The units shall meet or exceed the following specifications:
   a. Video
      1) Output: 1 volt pk-pk (75 ohms)
      2) Bandwidth: 5H2 - 10 MHZ
      3) Differential Gain: <5%
      4) Tilt: <1%
      5) Signal-Noise: 60dB
      6) Wavelength: 850nm
      7) Number of Fibers: 1
      8) Surface Mount: 106.7 x 88.9 x 25.4 mm (4.2 x 3.5 x 1 in)
      9) Operating Temp: -20 to 70 deg C (-4 to 158 deg F)
      10) Connectors:
      11) Power: Female plug block with screw clamps
      12) Video: BNC
      13) Optical: ST
      14) Power: 12 VAC8 Channel Fiber Optic Transceivers (Video & PTZ Control)

D. Fiber Optic Sub Rack with Power Supply:
1. The Card Cage Rack shall provide high-density racking for fiber-optic modules. The unit shall be designed to mount in standard 483 mm (19 in) instrument racks and to accommodate the equivalent of 15 1-inch modules.
   a. Specifications
      1) Card Orientation: Vertical
      2) Construction: Aluminum
      3) Current Consumption: 0.99 A
      4) Humidity: 95.0 % RH
      5) Input Power: 100-240 VAC, 60/50 Hz
      6) Mounting: Mounts in standard 483 mm (19 in) rack using four (4) screws (optional wall brackets purchased separately)
      7) Number of Outputs: 1.0
      8) Number of Slots 15.0

9) Operating Temperature: -40 to +75 deg C (-40.0 to 167.0 deg F)
10) Ouput Voltage: 13.5 V
11) Output Current 6.0 A
12) Power Dissipation: 28.0 W
13) Power Factor: 48.0
14) Power Supply: (built-in)
15) Rack Units: 3RU
16) Redundant Capability: Yes
17) Weight: 2.43 kg (5.35 lb)
18) Width: 483 mm (19.0 in)

2.4 TRANSIENT VOLTAGE SURGE SUPPRESSION DEVICES (TVSS) AND SURGE SUPPRESION

A. Transient Voltage Surge Suppression

1. All cables and conductors extending beyond building perimeter, except fiber optic cables, which serve as communication, control, or signal lines shall be protected against Transient Voltage surges and have Transient Voltage surge suppression protection (TVSS) UL listed in accordance with Standard 497B installed at each end. Lighting and surge suppression shall be a multi-strike variety and include a fault indicator. Protection shall be furnished at the equipment and additional triple solid state surge protectors rated for the application on each wire line circuit shall be installed within 915 mm (36 in) of the building cable entrance. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode using the following waveforms:
   a. A 10-microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
   b. An 8-microsecond rise time by 20-microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.
   c. Maximum series current: 2 AMPS. Provide units manufactured by Advanced Protection Technologies, model # TE/FA 10B or TE/FA 20B or approved equivalent.
   d. Operating Temperature and Humidity: -40 to + 85 deg C (-40 to 185 deg F), and 0 to 95 percent relative humidity, non-condensing.

B. Video Surveillance System

1. Protectors shall be installed on coaxial cable systems on points of entry and exit from separate buildings. Suppressors shall be installed at each exterior camera location and include protection for 12 and/or 24 volt power, data signal and motor controls (for Pan, Tilt and Zoom systems). SPDs shall protect all modes herein mentioned and contain all modes in a single unit system. Protection for all systems mentioned above shall be incorporated at the head end equipment. Additionally, a minimum 450VA battery back-up shall be used to protect the DVR or VCR and monitor. Protectors shall meet the following criteria:
   a. Head-End Power
   b. UL 1778, cUL (Battery Back Up)
   c. Minimum Surge Current Capacity: 65,000 Amps (8x20µsec)
   d. Minimum of two (2) NEMA 5-15R Receptacles (one (1) AC power only, one (1) with UPS)
   e. All modes protected (L-N, L-G, N-G)
   f. EMI/RFI Filtering
   g. Maximum Continuous Current: 12 Amps
   h. Camera Power
      1) Minimum Surge Current Capacity: 1,000 Amps (8X20µsec); 240 Amps for IP Video/PoE cameras
      2) Screw Terminal Connection
      3) All protection modes L-G (all Lines)
      4) MCOV <40VAC
   i. Video And Data
      1) Surge Current Capacity 1,000 Amps per conductor
      2) “BNC” Connection (Coax)
      3) Protection modes: L-G (Data), Center Pin-G, Shield-G (Coax)
      4) Band Pass 0-2GHz
      5) Insertion Loss <0.3dB

C. Grounding and Surge Suppression

1. The Security Contractor shall provide grounding and surge suppression to stabilize the voltage under normal operating conditions. This is to ensure the operation of over current devices, such as fuses, circuit breakers, and relays, underground-fault conditions.

2. The Contractor shall engineer, provide, and install proper grounding and surge suppression as required by local jurisdiction and prevailing codes and standards, referenced in this document.
3. Principal grounding components and features shall include: main grounding buses, grounding, and bonding connections to service equipment.
4. The Contractor shall provide detail drawings of interconnection with other grounding systems including lightning protection systems.
5. The Contractor shall provide details of locations and sizes of grounding conductors and grounding buses in electrical, data, and communication equipment rooms and closets.
6. AC power receptacles are not to be used as a ground reference point.
7. Any cable that is shielded shall require a ground in accordance with applicable codes, the best practices of the trade, and all manufactures' installation instructions.

D. 120 VAC Surge Suppression
1. Continuous Current: Unlimited (parallel connection)
2. Max Surge Current: 13,500 Amps
3. Protection Modes: L - N, L - G, N - G
4. Warranty: Ten Year Limited Warranty
5. Dimension: 73.7 x 41.1 x 52.1 mm (2.90 x 1.62 x 2.05 in)
6. Weight: 2.88 g (0.18 lbs)
7. Housing: ABS

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION

A. Comply with NECA 1.
B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

F. Equipment location shall be as close as practical to locations shown on the drawings.

G. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.

2. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, , motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

3.2 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section 07 84 00 "Firestopping."

3.3 COMMISIONING

A. Provide commissioning documentation 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. .

3.4 DEMONSTRATION AND TRAINING

A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

B. Training shall be provided for the particular equipment or system as required in each associated specification.

C. A training schedule shall be developed and submitted by the contractor and approved by the COR at least 30 days prior to the planned training.

D. Provide services of manufacturer’s technical representative for <insert hours> hours to instruct VA personnel in operation and maintenance of units.

3.5 WORK PERFORMANCE

A. Job site safety and worker safety is the responsibility of the contractor.

B. For work on existing stations, arrange, phase and perform work to assure electronic safety and security service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

C. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

D. Coordinate location of equipment and conduit with other trades to minimize interferences. See the GENERAL CONDITIONS.

3.6 SYSTEM PROGRAMMING

A. General Programming Requirements

1. This following section shall be used by the contractor to identify the anticipated level of effort (LOE) required setup, program, and configure the Electronic Security System (ESS). The contractor shall be responsible for providing all setup, configuration, and programming to include data entry for the Security Management System (SMS) and subsystems [(e.g., video matrix switch, intercoms, digital video recorders, intrusion devices, including integration of subsystems to the SMS (e.g., camera call up, time synchronization, intercoms)]. System programming for existing or new SMS servers shall not be conducted at the project site.

B. Level of Effort for Programming

1. The Contractor shall perform and complete system programming (including all data entry) at an offsite location using the Contractor’s own copy of the SMS software. The Contractor’s copy of the SMS software shall be of the Owners current version. Once system programming has been completed, the Contractor shall deliver the data to the COR on data entry forms and an approved electronic medium, utilizing data from the contract documents. The completed forms shall be delivered to the COR for review and approval at least 90 calendar days prior to the scheduled date the Contractor requires it. The Contractor shall not upload system programming until the COR has provided written approval. The Contractor is responsible for backing up the system prior to uploading new programming data. Additional programming requirements are provided as follows:

a. Programming for New SMS Server: The contractor shall provide all other system related programming. The contractor shall be responsible for uploading personnel information (e.g., ID Cards backgrounds, names, access privileges, personnel photos, access schedules, personnel groupings) along with coordinating with COR for device configurations, standards, and groupings. VA shall provide database to support Contractor's data entry tasks. The contractor shall anticipate a weekly coordination meeting and working with COR to ensure data uploading is performed without incident of loss of function or data loss.

b. Programming for Existing SMS Servers: The contractor shall perform all related system programming except for personnel data as noted. The contractor will not be responsible for uploading personnel information (e.g., ID Cards backgrounds, names, access privileges, access schedules, personnel groupings). The contractor shall anticipate a weekly coordination meeting and working alongside of COR to ensure data uploading is performed without incident of loss of function or data loss. System programming for SMS servers shall be performed by using the Contractor's own server and software. These servers shall not be connected to existing devices or systems at any time.

2. The Contractor shall identify and request from the COR, any additional data needed to provide a complete and operational system as described in the contract documents.

3. Contractor and COR coordination on programming requires a high level of coordination to ensure programming is performed in accordance with VA requirements and programming uploads do not disrupt existing systems functionality. The contractor shall anticipate a minimum a weekly coordination meeting. Contractor shall ensure data uploading is performed without incident of loss of function or data loss. The following Level of Effort Chart is provided to communicate the expected level of effort required by contractors on VA ESS projects. Calculations to determine actual levels of effort shall be confirmed by the contractor before project award.

Table 1 Contractor Level of Effort

	Description of Tasks					
Description of Systems	Develop System Loading Sheets	Coordination	Initial Set-up Configuration	System Programming	Final Checks	Level of Effort (Typical Tasks)
CCTV Systems	e.g., programming call-ups recording	e.g., confirming device configurations, naming conventions	e.g., enter data from loading sheets; camera naming convention, sequences, configure components)	e.g., programming call-ups recording	e.g., confirm area of coverage, call-up per event generated and recording rates	e.g., setting up cameras points, recording ratios (e.g., normal, alarm event) timed recording, linkages, maps placements, call-ups
Note: Programming tasks are supported through the contractor's development of the Technical Data package Submittals.						

3.7 TESTING AND ACCEPTANCE

A. Performance Requirements

1. General:

   a. The Contractor shall perform contract field, performance verification, and endurance testing and make adjustments of the completed security system when permitted. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing. Written notification of planned testing shall be given to the COR at least 60 calendar days prior to the test and after the Contractor has received written approval of the specific test procedures.

   b. The COR shall witness all testing and system adjustments during testing. Written permission shall be obtained from the COR before proceeding with the next phase of testing. Original copies of all data produced during performance verification and endurance testing shall be turned over to the COR at the conclusion of each phase of testing and prior to COR approval of the test.

2. Test Procedures and Reports: The test procedures, compliant w/ VA standard test procedures, shall explain in detail, step-by-step actions and expected results demonstrating compliance with the requirements of the specification. The test reports shall be used

to document results of the tests. The reports shall be delivered to the COR within seven (7) calendar days after completion of each test.

B. Pre-Delivery Testing

1. The purpose of the pre-delivery test is to establish that a system is suitable for installation. As such, pre-delivery test shall be a mock-up of the system as planned in the contract documents. The Contractor shall assemble the Security Test System at the Contractors local project within 50-miles of the project site and perform tests to demonstrate the performance of the system complies with the contract requirements in accordance with the approved pre-delivery test procedures. The tests shall take place during regular daytime working hours on weekdays. Model numbers of equipment tested shall be identical to those to be delivered to the site. Original copies of all data produced during pre-delivery testing, including results of each test procedure, shall be documented and delivered to the COR at the conclusion of pre-delivery testing and prior to COR's approval of the test. The test report shall be arranged so all commands, stimuli, and responses are correlated to allow logical interpretation. For Existing System modifications, the contractor shall provide their own server with loaded applicable software to support PDT.
2. Test Setup: The pre-delivery test setup shall include the following:
   a. All console equipment.
      1) At least one of each type of data transmission media (DTM) and associated equipment to provide a fully integrated PACS.
      2) The number of local processors shall equal the amount required by the site design.
      3) Enough sensor simulators to provide alarm signal inputs to the system equal to the number of sensors required by the design. The alarm signals shall be manually, or software generated.
      4) Contractor to prove to owner all systems are appropriately sized and configured as sized.
      5) Integration of VASS, intercom systems, other subsystems.
3. During the bidding process the contractor shall submit a request for information to the Owner to determine if a pre-delivery test shall

be required. If a pre-delivery test is not required, the contractor shall provide a written notification that the Pre-delivery Test is not required in their shop drawings submission.

C. The inspection and test will be conducted by a factory-certified contractor representative and witnessed by a Government Representative. The results of the inspection will be officially recorded by a designated Government Representative and maintained on file by the COR (RE), until completion of the entire project. The results will be compared to the Acceptance Test results.

D. Contractor’s Field Testing (CFT)

1. The Contractor shall calibrate and test all equipment, verify DTM operation, place the integrated system in service, and test the integrated system. Ground rods installed by this Contractor within the base of camera poles shall be tested as specified in IEEE STD 142. The Contractor shall test all security systems and equipment and provide written proof of a 100% operational system before a date is established for the system acceptance test. Documentation package for CFT shall include completed (fully annotated details of test details) for each device and system tested, and annotated loading sheets documenting complete testing to COR approval. CFT test documentation package shall conform to submittal requirements outlined in this Section. The Contractor’s field testing procedures shall be identical to the COR’s acceptance testing procedures. The Contractor shall provide the COR with a written listing of all equipment and software indicating all equipment and components have been tested and passed. The Contractor shall deliver a written report to theCOR stating the installed complete system has been calibrated, tested, and is ready to begin performance verification testing; describing the results of the functional tests, diagnostics, and calibrations; and the report shall also include a copy of the approved acceptance test procedure. Performance verification testing shall not take place until written notice by contractor is received certifying that a contractor’s field test was successful.

E. Performance Verification Test (PVT)

1. Test team:

a. After the system has been pretested and the Contractor has submitted the pretest results and certification to the COR, then the Contractor shall schedule an acceptance test to date and give the COR written, notice as described herein, prior to the date the acceptance test is expected to begin. The system shall be tested in the presence of a Government Representative, an OEM certified representative, representative of the Contractor and other approved by the COR. The system shall be tested utilizing the approved test equipment to certify proof of performance, FCC, UL and Emergency Service compliance. The test shall verify that the total system meets all the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.

2. The Contractor shall demonstrate the completed Physical Access Control System PACS complies with the contract requirements. In addition, the Contractor shall provide written certification that the system is 100% operational prior to establishing a date for starting PVT. Using approved test procedures, all physical and functional requirements of the project shall be demonstrated and shown. The PVT will be stopped and aborted as soon as 10 technical deficiencies are found requiring correction. The Contractor shall be responsible for all travel and lodging expenses incurred for out-of-town personnel required to be present for resumption of the PVT. If the acceptance test is aborted, the re-test will commence from the beginning with a retest of components previously tested and accepted.
3. The PVT, as specified, shall not begin until receipt of written certification that the Contractors Field Testing was successful. This shall include certification of successful completion of testing as specified in paragraph “Contractor’s Field Testing”, and upon successful completion of testing at any time when the system fails to perform as specified. Upon termination of testing by the COR or Contractor, the Contractor shall commence an assessment period as described for Endurance Testing Phase II.
4. Upon successful completion of the acceptance test, the Contractor shall deliver test reports and other documentation, as specified, to the COR prior to commencing the endurance test.

5. Additional Components of the PVT shall include:
   a. System Inventory
      1) All Device equipment
      2) All Software
      3) All Logon and Passwords
      4) All Cabling System Matrices
      5) All Cable Testing Documents
      6) All System and Cabinet Keys
   b. Inspection
      1) Contractor shall record an inspection punch list noting all system deficiencies. The contractor shall prepare an inspection punch list format for CORs approval.
      2) As a minimum the punch list shall include a listing of punch list items, punch list item location, description of item problem, date noted, date corrected, and details of how item was corrected.
6. Partial PVT - At the discretion of COR, the Performance Verification Test may be performed in part should a 100% compliant CFT be performed. In the event that a partial PVT will be performed instead of a complete PVT; the partial PVT shall be performed by testing 10% of the system. The contractor shall perform a test of each procedure on select devices or equipment.

F. Endurance Test
1. The Contractor shall demonstrate the specified probability of detection and false alarm rate requirements of the completed system. The endurance test shall be conducted in phases as specified below. The endurance test shall not be started until the COR notifies the Contractor, in writing, that the performance verification test is satisfactorily completed, training as specified has been completed, and correction of all outstanding deficiencies has been satisfactorily completed. VA shall operate the system 24 hours per day, including weekends and holidays, during Phase I and Phase III endurance testing. VA will maintain a log of all system deficiencies. The COR may terminate testing at any time the system fails to perform as specified. Upon termination of testing, the Contractor shall commence an assessment period as described for Phase II. During the last day of the test, the Contractor shall

verify the appropriate operation of the system. Upon successful completion of the endurance test, the Contractor shall deliver test reports and other documentation as specified to the COR prior to acceptance of the system.

2. Phase I (Testing): The test shall be conducted 24 hours per day for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized in writing by the COR. If the system experiences no failures, the Contractor may proceed directly to Phase III testing after receiving written permission from the COR.
3. Phase II (Assessment):
   a. After the conclusion of Phase I, the Contractor shall identify all failures, determine causes of all failures, repair all failures, and deliver a written report to the COR. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and recommend the point at which testing shall be resumed.
   b. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the COR. The meeting shall not be scheduled earlier than five (5) business days after the COR receives the report. As part of this test review meeting, the Contractor shall demonstrate all failures have been corrected by performing appropriate portions of the performance verification test. Based on the Contractor’s report and the test review meeting, the COR will provide a written determine of either the restart date or require Phase I be repeated.
4. Phase III (Testing): The test shall be conducted 24 hours per day for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized in writing by the COR.
5. Phase IV (Assessment):
   a. After the conclusion of Phase III, the Contractor shall identify all failures, determine causes of all failures, repair all failures, and deliver a written report to the COR. The report

shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and recommend the point at which testing should be resumed.

b. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the COR. The meeting shall not be scheduled earlier than five (5) business days after receipt of the report by the COR. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by repeating appropriate portions for the performance verification test. Based on the review meeting the test should not be scheduled earlier than five (5) business days after the COR receives the report. As a part of this test review meeting, the Contractor shall demonstrate all failures have been corrected by repeating appropriate portions of the performance verification test. Based on the Contractor’s report and the test review meeting, the COR will provide a written determine of either the restart date or require Phase III be repeated. After the conclusion of any re-testing which the COR may require, the Phase IV assessment shall be repeated as if Phase III had just been completed.

G. Exclusions

1. The Contractor will not be held responsible for failures in system performance resulting from the following:

a. An outage of the main power in excess of the capability of any backup power source provided the automatic initiation of all backup sources was accomplished and that automatic shutdown and restart of the PACS performed as specified.

b. Failure of an Owner furnished equipment or communications link, provided the failure was not due to Contractor furnished equipment, installation, or software.

c. Failure of existing Owner owned equipment, provided the failure was not due to Contractor furnished equipment, installation, or software.

---END---

---INTENTIONALLY BLANK---

SECTION 28 05 13
CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the finishing, installation, connection, testing and certification the conductors and cables required for a fully functional for electronic safety and security (ESS) system.

1.2 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.

B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.

C. 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.

D. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

E. Section 28 05 28.33 - CONDUITS AND BOXES FOR ELECTRONIC SECURITY AND SAFETY. Requirements for infrastructure.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. EMI: Electromagnetic interference.

C. IDC: Insulation displacement connector.

D. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

F. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

G. RCDD: Registered Communications Distribution Designer.

H. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.

I. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings

sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

J. UTP: Unshielded twisted pair.

1.4 QUALITY ASSURANCE

A. See Section 28 05 00 COMMON WORKS RESULTS FOR ELECTRONIC SAFETY AND SECURITY, Paragraph 1.4.

1.5 SUBMITTALS

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

1. Manufacturer's Literature and Data: Showing each cable type and rating.
2. Certificates: Two weeks prior to final inspection, deliver to the Contracting Officer’s Representative (COR) four copies of the certification that the material is in accordance with the drawings and specifications and diagrams for cable management system.
3. Shop Drawings: Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
   a. Vertical and horizontal offsets and transitions.
   b. Clearances for access above and to side of cable trays.
   c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
   d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.
   e. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 2 and 3.
4. Wiring Diagrams. Show typical wiring schematics including the following:
   a. Workstation outlets, jacks, and jack assemblies.
   b. Patch cords.
   c. Patch panels.
5. Cable Administration Drawings: As specified in Part 3 "Identification" Article.
6. Project planning documents as specified in Part 3.
7. Maintenance Data: For wire and cable to include in maintenance manuals.

1.6 APPLICABLE PUBLICATIONS

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

B. American Society of Testing Material (ASTM):

D2301-04.....Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape

C. Federal Specifications (Fed. Spec.):

A-A-59544-08.....Cable and Wire, Electrical (Power, Fixed Installation)

D. National Fire Protection Association (NFPA):

70-17.....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):

44-05.....Thermoset-Insulated Wires and Cables

83-08.....Thermoplastic-Insulated Wires and Cables

467-07.....Electrical Grounding and Bonding Equipment

486A-03.....Wire Connectors and Soldering Lugs for Use with Copper Conductors

486C-04.....Splicing Wire Connectors

486D-05.....Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations

486E-00.....Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

493-07.....Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable

514B-04.....Fittings for Cable and Conduit

1479-03.....Fire Tests of Through-Penetration Fire Stops

1.7 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use TDR
2. Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.

3. Test each pair of UTP cable for open and short circuits.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install UTP, optical fiber, and coaxial cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 GENERAL

A. General: All cabling locations shall be in conduit systems as outlined in Division 28 unless a waiver is granted in writing or an exception is noted on the construction drawings.

B. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.
4. Wire mesh spacing shall not exceed 2 by

C. Conduit and Boxes: Comply with requirements in Division 28 Section "Conduits and Backboxes for Electronic Safety and Security."[Flexible metal conduit shall not be used.]

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm).

2.3 UTP CABLE

A. Description: 100-ohm, 4-pair UTP, formed into 25-pair binder groups covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.

4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
   a. Communications, General Purpose: Type CM or CMG ; or MPP, CMP, MPR, CMR, MP, or MPG.
   b. Communications, Plenum Rated: Type CMP ; or MPP, complying with NFPA 262.
   c. Communications, Riser Rated: Type CMR ; or MPP, CMP, or MPR, complying with UL 1666.
   d. Communications, Limited Purpose: Type CMX ; or MPP, CMP, MPR, CMR, MP, MPG, CM, or CMG.
   e. Multipurpose: Type MP or MPG ; or MPP or MPR.
   f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
   g. Multipurpose, Riser Rated: Type MPR or MPP, complying with UL 1666.

2.4 UTP CABLE HARDWARE

A. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

B. Connecting Blocks: 110-style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25percent spare. Integral with connector bodies, including plugs and jacks where indicated.

2.5 OPTICAL FIBER CABLE

A. Description: Multimode, 50/125micrometer, 24fiber, tight buffer, interlocked armored, optical fiber cable.
   1. Comply with ICEA S-83-596 for mechanical properties.
   2. Comply with TIA/EIA-568-B.3 for performance specifications.
   3. Comply with TIA/EIA-492AAAA-B or TIA/EIA-492AAAA-A for detailed specifications.
   4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
      a. General Purpose, Nonconductive: Type OFN or OFNG , or OFNR, OFNP.
      b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.

c. Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.
d. General Purpose, Conductive: Type OFC or OFCG ; or OFNG, OFN, OFCR, OFNR, OFCP, or OFNP.
e. Plenum Rated, Conductive: Type OFCP or OFNP, complying with NFPA 262.
f. Riser Rated, Conductive: Type OFCR ; or OFNR, OFCP, or OFNP, complying with UL 1666.

5. Conductive cable shall be steel oraluminum armored type.
6. Maximum Attenuation: 3.50dB/km at 850 nm; 1.5 dB/km at 1300 nm.
7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

B. Jacket:
1. Jacket Color: Aqua for 50/125-micrometer cable and Orange for 62.5/125-micrometer cable.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.6 OPTICAL FIBER CABLE HARDWARE

A. Cable Connecting Hardware: Meet the Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
1. Quick-connect, simplex and duplex, Type SC connectors. Insertion loss shall be not more than 0.75 dB.
2. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 LOW-VOLTAGE CONTROL CABLE

A. Paired Lock Cable: NFPA 70, Type CMG.
1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.
   1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
   2. PVC insulation.
   3. Unshielded.
   4. PVC jacket.
   5. Flame Resistance: Comply with NFPA 262.
C. Paired Lock Cable: NFPA 70, Type CMG.
   1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
   2. PVC insulation.
   3. Unshielded.
   4. PVC jacket.
   5. Flame Resistance: Comply with UL 1581.
D. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.
   1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
   2. Fluorinated ethylene propylene insulation.
   3. Unshielded.
   4. Plastic jacket.
   5. Flame Resistance: NFPA 262, Flame Test.

2.8 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.
B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, power-limited cable, concealed in building finishes or power-limited tray cable, in cable tray complying with UL 83.
C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.9 IDENTIFICATION PRODUCTS

A. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.
B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.
C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

E. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

F. Cable shall be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

2.11 WIRE LUBRICATING COMPOUND

A. Suitable for the wire insulation and conduit it is used with and shall not harden or become adhesive.

B. Shall not be used on wire for isolated type electrical power systems.

2.12 FIREPROOFING TAPE

A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.

B. The tape shall be self-extinguishing and shall not support combustion. It shall be arc-proof and fireproof.

C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.

D. The finished application shall withstand a 200-ampere arc for not less than 30 seconds.

E. Securing tape: Glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19 mm (3/4 inch) wide.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.

5. Cables shall not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
9. Pulling Cable:
   a. Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
   b. Provide installation equipment that shall prevent the cutting or abrasion of insulation during pulling of cables.
   c. Use ropes made of nonmetallic material for pulling feeders.
   d. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the COR.
   e. Pull in multiple cables together in a single conduit.

C. Splice cables and wires where necessary only in outlet boxes, junction boxes, or pull boxes.
   1. Splices and terminations shall be mechanically and electrically secure.
   2. Where the Government determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Government.

D. Seal cable and wire entering a building from underground, between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.

E. Unless otherwise specified in other sections install wiring and connect to equipment/devices to perform the required functions as shown and specified.

F. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system shall not affect other systems.

G. Where separate power supply circuits are not shown, connect the systems to the nearest panel boards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.

H. Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.

I. System voltages shall be 120 volts or lower where shown on the drawings or as required by the NEC.

J. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

K. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.

L. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than [60 inches (1525 mm)] <Insert dimension> apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

M. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 72 inches (1830 mm)long shall be neatly coiled not less than 12 inches (300 mm) in diameter below each feed point.

N. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.2 CONTROL CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:
   1. Class 1 remote-control and signal circuits, No. 14 AWG.

2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.3 CONNECTIONS

A. Comply with requirements in Division 28 Section "VIDEO SURVEILLANCE" for connecting, terminating, and identifying wires and cables.

3.4 FIRESTOPPING

A. Comply with requirements in Division 07 Section "FIRESTOPPING."
B. Comply with TIA/EIA-569-A, "Firestopping" Annex A.
C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
B. For low-voltage wiring and cabling, comply with requirements in Division 28 Section "GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY."

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.
B. Install a permanent wire marker on each wire at each termination.
C. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
D. Wire markers shall retain their markings after cleaning.
E. In each handhole, install embossed brass tags to identify the system served and function.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
B. Perform tests and inspections.
C. Tests and Inspections:
1. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.
   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
4. Optical Fiber Cable Tests:
   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
   b. Link End-to-End Attenuation Tests:
      1) Multimode Link Measurements: Test at 850 or 1300 nm in one direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
      2) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide or transfer the data from the instrument to the computer, save as text files, print, and submit.

E. End-to-end cabling shall be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.8 EXISTING WIRING

A. Unless specifically indicated on the plans, existing wiring shall not be reused for the new installation. Only wiring that conforms to the specifications and applicable codes shall be reused. If existing wiring does not meet these requirements, existing wiring shall not be reused and new wires shall be installed.

---END---

---INTENTIONALLY BLANK---

SECTION 28 05 26
GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the finishing, installation, connection, testing and certification of the grounding and bonding required for a fully functional Electronic Safety and Security (ESS) system.

B. "Grounding electrode system" refers to all electrodes required by NEC, as well as including made, supplementary, grounding electrodes.

C. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning

1.2 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.

B. Section 28 05 00 - REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS. For general electrical requirements, quality assurance, coordination, and project conditions that are common to more than one section in Division 28.

C. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for low voltage power and lighting wiring.

1.3 SUBMITTALS

A. Submit in accordance with Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

B. Shop Drawings:

1. Clearly present enough information to determine compliance with drawings and specifications.
2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.

C. Test Reports: Provide certified test reports of ground resistance.

D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the COR:

1. Certification that the materials and installation are in accordance with the drawings and specifications.
2. Certification by the contractor that the complete installation has been properly installed and tested.

1.4 APPLICABLE PUBLICATIONS

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

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

B1-07.....Standard Specification for Hard-Drawn Copper Wire

B3-07.....Standard Specification for Soft or Annealed Copper Wire

B8-04.....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

81-1983.....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

C2-07.....National Electrical Safety Code

D. National Fire Protection Association (NFPA):

70-18.....National Electrical Code (NEC)

99-2018.....Health Care Facilities

E. Underwriters Laboratories, Inc. (UL):

44-05 .....Thermoset-Insulated Wires and Cables

83-08 .....Thermoplastic-Insulated Wires and Cables

467-07 .....Grounding and Bonding Equipment

486A-486B-03 .....Wire Connectors

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 25 mm² (4 AWG) and larger shall be permitted to be identified per NEC.

B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be ASTM B1 solid bare copper wire.

2.2 GROUND RODS

A. Copper clad steel, 19 mm (3/4-inch) diameter by 3000 mm (10 feet) long, conforming to UL 467.

B. Quantity of rods shall be as required to obtain the specified ground resistance.

2.3 SPLICES AND TERMINATION COMPONENTS

A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).2.4 ground connections

B. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

C. Below Grade: Exothermic-welded type connectors.

D. Above Grade:

1. Bonding Jumpers: Compression-type connectors, using zinc-plated fasteners and external tooth lockwashers.
2. Connection to Building Steel: Exothermic-welded type connectors.
3. Ground Busbars: Two-hole compression type lugs, using tin-plated copper or copper alloy bolts and nuts.
4. Rack and Cabinet Ground Bars: One-hole compression-type lugs, using zinc-plated or copper alloy fasteners.
5. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
   a. Pipe Connectors: Clamp type, sized for pipe.
6. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 EQUIPMENT RACK AND CABINET GROUND BARS

A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 4 mm thick by 19 mm wide (3/8 inch x ¾ inch).

2.5 GROUND TERMINAL BLOCKS

A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

2.6 SPLICE CASE GROUND ACCESSORIES

A. Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 16 mm^2 (6 AWG) insulated ground wire with shield bonding connectors.

2.7 COMPUTER ROOM GROUND

A. Provide 50mm2 (1/0 AWG) bare copper grounding conductors bolted at mesh intersections to form an equipotential grounding grid. The equipotential grounding grid shall form a 600mm (24 inch) mesh pattern. The grid shall be bonded to each of the access floor pedestals.

2.8 SECURITY CONTROL ROOM GROUND

A. Provide 50mm2 (1/0 AWG) stranded copper grounding conductor(s) color coded with a green jacket, bolted at the Room's Communications System Grounding Electrode Cooper Plate and circulate to each equipment rack ground buss bar through the wire management system. Connect each equipment rack, wire management system's cable tray, and ladder to the circulating ground wire with a minimum 25mm2 (4AWG) stranded Cooper Wire, color coded with a green jacket.
   1. Connect each equipment rack ground buss bar to the circulating ground wire a indicated in 2.9.A, and
   2. Connect each additional room item to the circulating ground wire as indicated in 2.9.A.

PART 3 - EXECUTION

3.1 GENERAL

A. Ground in accordance with the NEC, as shown on drawings, and as specified herein.

B. System Grounding:
   1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
   2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

C. Equipment Grounding: Metallic structures, including ductwork and building steel, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.3 CORROSION INHIBITORS

A. When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.4 CONDUCTIVE PIPING

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

3.5 COMPUTER ROOM/SECURITY EQUIPMENT ROOM GROUNDING

A. Conduit: Ground and bond metallic conduit systems as follows:
   1. Ground metallic service conduit and any pipes entering or being routed within the computer room at each end using 16 mm² (6AWG) bonding jumpers.
   2. Bond at all intermediate metallic enclosures and across all joints using 16 mm² (6 AWG) bonding jumpers.

3.6 WIREWAY GROUNDING

A. Ground and Bond Metallic Wireway Systems as follows:
   1. Bond the metallic structures of wireway to provide 100 percent electrical continuity throughout the wireway system by connecting a 16 mm² (6 AWG) bonding jumper at all intermediate metallic enclosures and across all section junctions.
   2. Install insulated 16 mm² (6 AWG) bonding jumpers between the wireway system bonded as required in paragraph 1 above, and the closest building ground at each end and approximately every 16 meters (50 feet).
   3. Use insulated 16 mm² (6 AWG) bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and cross all section junctions.
   4. Use insulated 16 mm² (6 AWG) bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 meters.

3.7 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.

B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems shall be used to meet the required resistance, but the specified number of electrodes shall still be provided.

C. Services at power company interface points shall comply with the power company ground resistance requirements.

D. Below-grade connections shall be visually inspected by the COR prior to backfilling. The contractor shall notify the COR 24 hours before the connections are ready for inspection.

3.8 LABELING

A. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it shall be removed for any reason, notify the facility manager."
2. All ground Busses shall be labeled “Main Ground Bus”, “Telecom Room Ground Bus.”
3. All grounding cabling shall be labeled, “Ground Cable Bonded from Main TGB,” “Ground Cable Bonded from the Main Electrical Ground Bus” “Ground Cable Bonded from Electrical Panel XXX”, “Ground Cable Bonded to the Building Steel.”

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal at individual ground rods. Make tests at ground rods before any conductors are connected.
   a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.

C. Grounding system shall be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:
   1. Power Distribution Units or Panel boards Serving Electronic Equipment: 3 ohm(s).
   2. Manhole Grounds: 10 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

---END---

--- INTENTIONALLY BLANK ---

SECTION 28 05 28.33
CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the finishing, installation, connection, testing certification of the conduit, fittings, and boxes to form a complete, coordinated, raceway system(s). Conduits and when approved separate UL Certified and Listed partitioned telecommunications raceways are required for a fully functional Electronic Safety and Security (ESS) system. Raceways are required for all electronic safety and security cabling unless shown or specified otherwise.

B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.

B. Section 07 84 00 - FIRESTOPPING. Requirements for sealing around penetrations to maintain the integrity of fire rated construction.

C. Section 07 92 00 - JOINT SEALANTS. Requirements for sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.

D. Section 09 91 00 - PAINTING. Requirements for identification and painting of conduit and other devices.

E. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. For general electrical requirements, general arrangement of the contract documents, coordination, quality assurance, project conditions, equipment and materials, and items that is common to more than one section of Division 28.

F. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

1.4 QUALITY ASSURANCE

A. Refer to Paragraph 1.4 Quality Assurance, in Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

1.5 SUBMITTALS

A. Submit in accordance with Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Furnish the following:

B. Shop Drawings:

1. Size and location of main feeders;
2. Size and location of panels and pull boxes.
3. Layout of required conduit penetrations through structural elements.
4. The specific items proposed and its area of application shall be identified on the catalog cuts.

C. Certification: Prior to final inspection, deliver to the Contracting Officer’s Representative (COR) four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

D. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

E. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.

F. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

G. Source quality-control test reports.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent

referenced. Publications are referenced in the text by the basic designation only.

B. National Electrical Manufacturers Association (NEMA):

TC-3-04	PVC Fittings for Use with Rigid PVC Conduit and Tubing
FB1-07	Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

C. National Fire Protection Association (NFPA):

70-18	National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):

1-05	Flexible Metal Conduit
5-04	Surface Metal Raceway and Fittings
6-07	Rigid Metal Conduit
50-07	Enclosures for Electrical Equipment
360-09	Liquid-Tight Flexible Steel Conduit
467-07	Grounding and Bonding Equipment
514A-04	Metallic Outlet Boxes
514B-04	Fittings for Cable and Conduit
514C-02	Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
651-05	Schedule 40 and 80 Rigid PVC Conduit
651A-07	Type EB and A Rigid PVC Conduit and HDPE Conduit
797-07	Electrical Metallic Tubing
1242-06	Intermediate Metal Conduit

PART 2 - PRODUCTS

2.1 GENERAL

A. Conduit Size: In accordance with the NEC, but not less than 20 mm (3/4 inch) unless otherwise shown.

2.2 CONDUIT

A. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.

B. Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.

C. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 volts or less.

D. Flexible galvanized steel conduit: Shall Conform to UL 1.

E. Liquid-tight flexible metal conduit: Shall Conform to UL 360.

2.3 WIREWAYS AND RACEWAYS

A. Surface metal raceway: Shall Conform to UL 5.

2.4 CONDUIT FITTINGS

A. Rigid steel and IMC conduit fittings:

1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
2. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
3. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
4. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
5. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
6. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.

B. Electrical metallic tubing fittings:

1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
2. Only steel or malleable iron materials are acceptable.
3. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller. Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches). Use set screws of case-hardened

steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.

4. Indent type connectors or couplings are prohibited.
5. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.

C. Flexible steel conduit fittings:
1. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
2. Clamp type, with insulated throat.

D. Liquid-tight flexible metal conduit fittings:
1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
2. Only steel or malleable iron materials are acceptable.
3. Fittings shall incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

E. Direct burial plastic conduit fittings:
1. Fittings shall meet the requirements of UL 514C and NEMA TC3.
2. As recommended by the conduit manufacturer.

F. Surface metal raceway fittings: As recommended by the raceway manufacturer.

G. Expansion and deflection couplings:
1. Conform to UL 467 and UL 514B.
2. Accommodate, 19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30-degree angular deflections.
3. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
4. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

2.5 CONDUIT SUPPORTS

A. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.

B. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.

C. Multiple conduit (trapeze) hangers: Not less than 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3/8 inch) diameter steel hanger rods.

D. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

2.6 OUTLET, JUNCTION, AND PULL BOXES

A. UL-50 and UL-514A.

B. Cast metal where required by the NEC or shown and equipped with rustproof boxes.

C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

D. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.

E. Sheet metal boxes: Galvanized steel, except where otherwise shown.

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

2.7 CABINETS

A. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

B. Hinged door in front cover with flush latch and concealed hinge.

C. Key latch to match panelboards.

D. Metal barriers to separate wiring of different systems and voltage.

E. Accessory feet where required for freestanding equipment.

2.8 WIREWAYS

A. Equip with hinged covers, except where removable covers are shown.

2.9 WARNING TAPE

A. Standard, 4-Mil polyethylene 76 mm (3 inches) wide tape non-detectable type, red with black letters, and imprinted with “CAUTION BURIED ELECTRONIC SAFETY AND SECURITY CABLE BELOW”.

2.10 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Section 07 84 00 "FIRESTOPPING."

2.11 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: Remarks: Remarks: [EPDM] [NBR] <Insert sealing element> interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Remarks: Remarks: [Plastic] [Carbon steel] [Stainless steel]. Include two for each sealing element.
3. Connecting Bolts and Nuts: [Carbon steel with corrosion-resistant coating] [Stainless steel] of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.12 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time. WIRELINE DATA TRANSMISSION MEDIA FOR SECURITY SYSTEMS

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:

1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the COR prior to drilling through structural sections.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the COR as required by limited working space.

B. Fire Stop: Where conduits, wireways, and other electronic safety and security raceways pass through fire partitions, fire walls, smoke

partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, "FIRESTOPPING", with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Section 07 92 00, "JOINT SEALANTS".

3.2 INSTALLATION, GENERAL

A. Install conduit as follows:

1. In complete runs before pulling in cables or wires.
2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
5. Mechanically continuous.
6. Independently support conduit at 2.4 m (8 foot) on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).
7. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.
8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
9. Conduit installations under fume and vent hoods are prohibited.
10. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
11. Do not use aluminum conduits in wet locations.
12. Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors and ceilings.

B. Conduit Bends:

1. Make bends with standard conduit bending machines.

2. Conduit hickey shall be used for slight offsets, and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

C. Layout and Homeruns:
1. Install conduit with wiring, including homeruns, as shown.
2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the COR.

3.3 CONCEALED WORK INSTALLATION

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

B. Furred or Suspended Ceilings and in Walls:
1. Conduit for conductors above 600 volts:
   a. Rigid steel or rigid aluminum.

b. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.

2. Conduit for conductors 600 volts and below:
   a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.
3. Align and run conduit parallel or perpendicular to the building lines.
4. Connect recessed lighting fixtures to conduit runs with maximum 1800 Remarks:mm (6 feet) of flexible metal conduit extending from a junction box to the fixture.
5. Tightening set screws with pliers is prohibited.

3.4 EXPOSED WORK INSTALLATION

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

B. Conduit for Conductors 600 volts and below:
   1. Rigid steel, IMC, or EMT. Different type of conduits mixed indiscriminately in the system is prohibited.

C. Align and run conduit parallel or perpendicular to the building lines.

D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.

E. Support horizontal or vertical runs at not over 2400 mm (eight foot) intervals.

F. Surface metal raceways: Use only where shown.

G. Painting:
   1. Paint exposed conduit as specified in Section 09 91 00, “PAINTING”.
   2. Paint all conduits containing cables rated over 600 volts safety orange. Refer to Section 09 91 00, “PAINTING” for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (two inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.

3.5 EXPANSION JOINTS

A. Conduits 75 mm (3 inches) and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

B. Provide conduits smaller than 75 mm (3 inches) with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 125 mm (5 inch) vertical drop midway between the ends. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 375 mm (15 inches) and larger conduits are acceptable.

C. Install expansion and deflection couplings where shown.

D. Seismic Areas: In seismic areas, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 375 mm (15 inches) of slack flexible conduit. Flexible conduit shall have a copper green ground bonding jumper installed.

3.6 CONDUIT SUPPORTS, INSTALLATION

A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.

B. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.

C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other approved fasteners.

D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

E. Fasteners and Supports in Solid Masonry and Concrete:

1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
2. Existing Construction:
   a. Steel expansion anchors not less than 6 mm (1/4 inch) bolt size and not less than 28 mm (1-1/8 inch) embedment.
   b. Power set fasteners not less than 6 mm (1/4 inch) diameter with depth of penetration not less than 75 mm (3 inches).
   c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.

F. Hollow Masonry: Toggle bolts are permitted.

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

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

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

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

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

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

3.7 BOX INSTALLATION

A. Boxes for Concealed Conduits:

1. Flush mounted.
2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.

C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

D. Outlet boxes in the same wall mounted back-to-back are prohibited. A minimum 600 mm (24 inch), center-to-center lateral spacing shall be maintained between boxes).

E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 100 mm (4 inches) square by 55 mm (2-1/8 inches) deep, with device covers for the wall material and thickness involved.

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

G. On all Branch Circuit junction box covers, identify the circuits with black marker.

3.8 ELECTRONIC SAFETY AND SECURITY CONDUIT

A. Install the electronic safety and security raceway system as shown on drawings.

B. Minimum conduit size of 19 mm (3/4 inch), but not less than the size shown on the drawings.

C. All conduit ends shall be equipped with insulated bushings.

D. All 100 mm (four inch) conduits within buildings shall include pull boxes after every two 90-degree bends. Size boxes per the NEC.

E. Vertical conduits/sleeves through closets floors shall terminate not less than 75 mm (3 inches) below the floor and not less than 75 mm (3 inches) below the ceiling of the floor below.

F. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.

G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.

H. All empty conduits located in communications closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.

I. Conduit runs shall contain no more than four quarter turns (90-degree bends) between pull boxes/backboards. Minimum radius of communication conduit bends shall be as follows (special long radius):

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
¾	150 (6)
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

J. Furnish and install 19 mm (3/4 inch) thick fire-retardant plywood specified on the wall of communication closets where shown on drawings. Mount the plywood with the bottom edge 300 mm (one foot) above the finished floor.

K. Furnish and pull wire in all empty conduits. (Sleeves through floor are exceptions).

---END---

SECTION 28 23 00
VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide and install a complete Video Surveillance System, which is identified as the Video Assessment and Surveillance System hereinafter referred to as the VASS 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 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 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.

D. Section 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.

E. 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.

F. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.

G. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.

H. Section 28 05 28.33 - CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.

I. Section 28 23 10 NETWORK VIDEO RECORDER

J. Section 28 23 20 VIDEO MANAGEMENT SYSTEM

K. Section 28 23 40 VIDEO IP CAMERAS

1.3 DEFINITIONS

A. AGC: Automatic gain control.

B. B/W: Black and white.

C. CCD: Charge-coupled device.

D. CIF: Common Intermediate Format CIF images are 352 pixels wide and 88/240 (PAL/NTSC) pixels tall (352 x 288/240).

E. 4CIF: resolution is 704 pixels wide and 576/480 (PAL/NTSC) pixels tall (704 x 576/480).

F. H.264 (also known as MPEG4 Part 10): a encoding format that compresses video much more effectively than older (MPEG4) standards.

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. NTSC: National Television System Committee.

K. UPS: Uninterruptible power supply.

L. PTZ: refers to a movable camera that has the ability to pan left and right, tilt up and down, and zoom or magnify a scene.

1.4 QUALITY ASSURANCE

A. The Contractor shall be responsible for providing, installing, and the operation of the VASS 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.
3. None of the new security surveillance cameras supplied by the contractor will be sourced from Chinese manufacturers in accordance with the National Defense Authorization Act, or NDAA. Contractor to ensure no new cameras are refurbished cameras from China.

F. Contractor Qualification:

1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of three (3) 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 (VASS) 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 shall 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 VASS. 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 4 hours 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 COR 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 shall 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 shall render satisfactory service to this installation within eight 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.
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:
   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).
   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 shall 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).
d. Power supply or circuit breaker and power panel number.
e. In addition, for the VASS 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 the COR to ensure all work has been clearly defined and completed. All reviews shall be conducted in accordance with the project schedule. There shall be four (4) stages to the review process:
1. 35 percent
2. 65 percent
3. 90 percent
4. 100 percent

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.

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):

330-09	Electrical 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 Commission (FCC):

E. (47 CFR 15) Part 15 Limitations on the Use of Wireless Equipment/Systems

F. National Electrical Contractors Association (NECA):

303-2005	Installing Closed Circuit Television (CCTV) Systems

G. National Fire Protection Association (NFPA):

70-2017	Article 780-National Electrical Code

H. Federal Information Processing Standard (FIPS):

140-2-02	Security Requirements for Cryptographic Modules

I. Underwriters Laboratories, Inc. (UL):

983-06	Standard 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. To connecting raceways, cables, wireways, cable trays, and busways shall 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 VASS 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. Video signal format shall comply with Ethernet IP signal at 100 Ohms.

B. 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.

C. 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.

D. 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.

E. 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 video encoders

and DVRs with multiple analog cameras require a license per channel to operate.

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.

2.2 VIDEO DISPLAY EQUIPMENT

A. Video Display Equipment

1. Will consist of color monitors and shall be EIA 375A compliant.
2. Shall be able to display analog, digital, and other images in either NTSC or MPEG format associated with the operation of the Security Management System (SMS).
3. Shall:

a. Have front panel controls that provide for power on/off, horizontal and vertical hold, brightness, and contrast.

b. Accept multiple inputs, either directly or indirectly.

c. Have the capabilities to observe and program the VASS System.

d. Be installed in a manner that they cannot be witnessed by the general public.

B. Color Video Monitors Technical Characteristics:

Sync Format	PAL/NTSC
Display Tube	90° deflection angle
Horizontal Resolution	250 TVL minimum, 300 TVL typical
Video Input	1.0 Vp-p, 75 Ohm
Front Panel Controls	Volume, Contrast, Brightness, Color
Connectors	BNC

C. Liquid Crystal Display (LCD) Flat Panel Display Monitor

D. The color LCD monitor shall have a flat screen and area and consists of an LCD panel, bezel, and stand.

E. The monitor shall meet or exceed the following specifications:

1. The pixel pitch of the monitor’s LCD panel shall be 0.264 mm horizontal and 0.264 mm vertical.

2. The monitor shall have a maximum resolution of 500 television lines.
3. The contrast ratio shall be 500:1.
4. The typical brightness shall be 250 cd/m²
5. The monitor shall display at least 16.7 million colors.
6. The light source for the LCD panel shall have a lifetime of 50,000 hours.
7. The scan frequency horizontal shall be 30 K to 80 KHz and the scan frequency vertical shall be 56 to 75 Hz.
8. The viewing angle for the monitor shall be 170 degrees horizontal and 170 degrees vertical.
   a. The monitor shall have automatic NTSC or PAL recognition.
   b. The monitor shall have a picture-in-picture function.
   c. The monitor shall use the following signal connectors:
   d. Video 1.0 V peak-to-peak at 75 ohms
   e. BNC in/out
   f. Y/C (S-video) in/out
   g. Audio in/out
   h. VGA 15-pin D-Sub
9. The monitor shall have one/two audio speaker(s).
   a. The speaker shall be 0.5 W minimum.
10. The monitor shall have the following front control panel buttons:
   a. Power on/off
   b. LED indicator
   c. Mode
   d. Increase (volume)
   e. Decrease (volume)
   f. Up (contrast adjustment)
   g. Down (brightness adjustment)
   h. Menu
   i. Auto

F. The monitor shall have the following options for adjustment in an onscreen display menu:
   a. Color
   b. Tint
      1) NTSC mode only
         a) Brightness
         b) Contrast

c) Sharpness

d) Volume

e) Language

f) Scan

g) Color Temp

h) H-Position

i) Recall

G. The electrical specifications for the monitor shall be as follows:

1. Input voltage shall be 12 VDC/3 A.
2. Power consumption shall be 50 W maximum.

H. The environmental specifications for the monitor shall be as follows:

1. Operating temperature shall be 32 to 104 degrees Fahrenheit or 0 to 40 degrees Celsius.
2. Operating humidity shall be 10 to 85 percent.

I. The physical specifications for the monitor shall be as follows:

J. The monitor shall conform to these compliance standards:

1. FCC
2. CE (EMC/LVD)
3. UL

2.3 CONTROLLING EQUIPMENT

A. Shall be utilized to call up, operate, and program all cameras associated VASS 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 VASS 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 VASS 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

2.4 POWER SUPPLIES

A. Power supplies shall be from an enhanced PoE data switch.

B. B.O.D.: Cisco 3850 series with 2-10Gig Uplink and software.

2.5 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 shall be sized and installed per the NEC. All security system signal and power cables that traverse or originate in a high security office space shall 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 shall 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 than 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. Cables:

1. CCTV video signal cables shall be copper 4 PR UTP for up to 295 feet and have a characteristic impedance of 100 ohms plus or minus 5 ohms.
2. CCTV video camera cables for cameras that are over 295 feet shall be Fiber optic cable, provide transceiver at each camera, and provide 4 PR UTP for power.
3. Cables:
   a. Signal wiring for PoE cameras depends on the distance the camera is being installed from either a hub or the server.
   b. If the camera is up to 295 ft from a hub or the server, then use a shielded UTP category 6 (CAT-VI) cable a with standard RJ-45 connector at each end. The cable with comply with the Power over Ethernet, IEEE802.3af, Standard.
   c. If the camera is over 300 ft from a hub or server then utilize a multimode fiber optic cable with a minimum size of 50 microns.
   d. Provide a separate cable for power.
   e. CAT-6 Technical Characteristics:

Number of Pairs	4
Total Number of Conductors	8
AWG	24
Stranding	Solid
Conductor Material	BC - Bare Copper
Insulation Material	PO – Polyolefin
Overall Nominal Diameter	.230 in.

IEC Specification	11801 Category 6
TIA/EIA Specification	568-B.2 Category 6e
Max. Capacitance Unbalance	(pF/100 m) 150 pF/100 m
Nom. Velocity of Propagation	70 %
Max. Delay	(ns/100 m) 538 @ 100MHz
Max. Delay Skew	(ns/100m) 45 ns/100 m
Max. Conductor DC Resistance	9.38 Ohms/100
Max. DCR Unbalance@ 20°C	3 %
Max. Operating Voltage	UL 300 V RMS

4. Fiber Optic Cables Technical Characteristics:

Fiber Type	50 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	300 meters
Maximum Gigabit Ethernet	550 meters

5. Power Cables
   a. Will be sized accordingly and shall comply with the NEC. High voltage power cables shall be a minimum of three conductors, 14 AWG, stranded, and coated with a non-conductive polyvinylchloride (PVC) jacket. Low voltage cables shall be a minimum of 18 AWG, stranded and non-conductive polyvinylchloride (PVC) jacket.

b. Will be utilized for all components of the VASS System that require either a 110 VAC 60 Hz or 220 VAC 50 Hz input. Each feed shall 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 be determined using a basic voltage over distance calculation and shall comply with the NEC's requirements for low voltage cables.

2.6 SPARE PARTS

A. Provide 1-24 port PoE switch.

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 shall 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 VASS System shall 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 VASS 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-hour basis.
   c. Be programmed to 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-hour basis.
   c. Be programmed to go into an alarm state when an IDS device is put into an alarm state and notify the PACS.
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-hour basis.
   c. The VASS System shall have 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-hour 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 manufacturer's 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 VASS System shall be comprised of 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 shall 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 VASS 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.
6. The Contractor shall return all removed cameras and security camera equipment to the COR during each demolition phase of work.

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 shall 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 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. Switcher:

1. Install the switcher as shown in the design and construction documents, and according to the OEM.
2. Connect all subassemblies as specified by the manufacturer and as shown.
3. Connect video signal inputs and outputs as shown and specified; terminate video inputs as required.
4. Connect alarm signal inputs and outputs as shown and specified; connect control signal inputs and outputs for ancillary equipment or secondary control/monitoring sites as specified by the manufacturer and as shown.
5. Connect the switcher CPU and switcher subassemblies to AC power.
6. Load all software as specified and required for an operational VASS System configured for the site and building requirements, including

data bases, operational parameters, and system, command, and application programs.

7. Provide the original and 2 backup copies for all accepted software upon successful completion of the endurance test.
8. Program the video annotation for each camera.

Q. Video Encoder/Decoder

1. Install the Video Encoder/Decoder per design and construction documents, and as specified by the OEM.
2. Connect analog camera inputs to video encoder.
3. Connect network camera to video decoder.
4. Connect video encoder to VASS network.
5. Connect video decoder to video matrix, DVR, and monitor.
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 VASS 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)
   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 VASS 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)

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 VASS System until the following items have been completed:

1. VASS System equipment items and have been set up in accordance with manufacturer's instructions.

2. A visual inspection of the VASS 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 VASS System have been verified as the correct voltage, phasing, and frequency as indicated.

B. The Commissioning Agent shall observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Contracting Officer's Representative 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 VASS System; and are approved by the Contracting Officer.

B. The Contractor shall 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 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 for four hours to instruct VA personnel in operation and maintenance of units.

---END---

SECTION 28 23 10
NETWORK VIDEO RECORDER

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide and install a complete Network Video recorder as part of the Video Surveillance System, which is identified as the Video Assessment and Surveillance System hereinafter referred to as the VASS System as specified in this section.

B This Section includes Network Video Recorder.

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 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.

D. Section 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES(600 VOLTS AND BELOW). Requirements for power cables.

E. 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.

F. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.

G. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.

H. Section 28 05 28.33 - CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY

I. Section 28 23 00 VIDEO SURVEILLANCE

J. Section 28 23 20 VIDEO MANAGEMENT SYSTEM

L. Section 28 23 40 VIDEO IP CAMERAS

1.3 AMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate with Owner or Owner’s representative regarding network configuration and estimated throughput utilization prior to performing network connections.

B. Sequencing / Scheduling: Provide to Owner or Owner’s representative a schedule and list of participants required to attend coordination and progress update meetings.

1. Owner representative(s) for Facilities Management, Information Technology (IT) Services, and Security Management.
2. General Contractor.
3. Project Manager.
4. Manufacturer’s Representative.
5. Project Architect.
6. Project Engineer.
7. Security Consultant.

1.4 INFORMATIONAL SUBMITTALS

A. Submit under provisions of Section 01 33 23.

B. Product Data: Manufacturer's product information and data sheets for each product specified in this section, including:
   1. Substrate preparation instructions and recommendations
   2. Installation means and methods.
   3. Recommendations and requirements for proper storage and handling.

C. Shop Drawings:
   1. Submit Manufacturer’s approved shop drawings detailing the section and elevation views of each product to be installed.
   2. Coordinate with locations listed on Contract Drawings.

D. Warranty Information:
   1. Submit confirmation and details of manufacturer’s warranty, extended warranty, and replacement policies.

E. System Support Resources:
   1. Submit a list of available manufacturers providing fee based professional services available to the Contractor or Owner, including but not limited to the following:
   2. Training.
   3. Installation.
   4. Commissioning.
   5. Remote diagnostics and integration with 3rd party software and hardware systems.

1.5 CLOSEOUT SUBMITTALS

A. Supply licensing and registration information for all software, hardware, firmware, operational, and administrative licenses.

B. Supply network configuration backup files, restoration application and instructions.

1.6 WARRANTY

A. Manufacturer Warranty: Provide manufacturer’s warranty covering parts and labor costs to repair or replace part that fail to perform.
   1. Warranty Period: Parts and labor warranty for 36 months from date of Substantial Completion or date of purchase, whichever comes first.
   2. Service During Warranty: Provide direct support to Owner via phone and email, including access to training and education in the form of documents, videos and other materials via the internet.

1.7 QUALITY ASSURANCE

A. The Contractor shall be responsible for providing, installing, and the operation of the VASS 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.
   3. None of the new security surveillance cameras supplied by the contractor will be sourced from Chinese manufacturers in accordance with the National Defense Authorization Act, or NDAA. Contractor to ensure no new cameras are refurbished from China.

F. Contractor Qualification:

1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of three (3) 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 (VASS) 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 shall 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 VASS. 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 4 hours 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 COR 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 shall 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 shall render satisfactory service to this installation eight hours of receipt of notification that service is needed. Submit name and address of service organizations.

H. Installers:

1. Performs Network Video Recorder (NVR) installation, configuration, setup, programming and related work employing authorized integrators/electronic technicians certified by manufacturer.
2. Certification for authorized integrators/electronic technicians shall include, at a minimum, installation and service of equipment provided.

1.8 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):

330-09 Electrical 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 inLow-Voltage AC Power Circuits

802.3af-08 Power over Ethernet Standard

D. Federal Communications Commission (FCC):

E. (47 CFR 15) Part 15 Limitations on the Use of Wireless Equipment/Systems

F. National Electrical Contractors Association (NECA):

303-2005 Installing Closed Circuit Television (CCTV) Systems

G. National Fire Protection Association (NFPA):

70-2017 Article 780-National Electrical Code

H. Federal Information Processing Standard (FIPS):

140-2-02 Security Requirements for Cryptographic ModulesI.

H. Underwriters Laboratories, Inc. (UL):

983-06 Standard for Surveillance Camera Units

3044-01 Standard for Surveillance Closed Circuit Television Equipment

1.9 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. To connecting raceways, cables, wireways, cable trays, and busways shall 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.

1.10 WARRANTY OF CONSTRUCTION

A. Warrant VASS 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 MANUFACTURERS

A. Basis of Design Manufacturer: Avigilon.

Website: www.avigilon.com. B. Substitution Limitations:

Single manufacturer will provide, from a single source, a fully integrated surveillance system consisting of network video recorders and the following components:

IP Video Cameras.

Video Management System Interfaces.

Video Surveillance Positioning Equipment.

Video Surveillance Sensors.

2.2 PERFORMANCE REQUIREMENTS

A. Throughput: NVR system must be capable of managing a combined 2100 Mbps of total throughput with handling for simultaneous recording, playback and live streaming.

C. Storage Capacity: System must be capable of storing up to 504TB raw or 432TB when configured as RAID 60.

D. Expansion: System must be configured to be capable of future expansion and scaling.

E. Mounting: Standard server enclosure (rack) mounting, requiring no greater than a 2U configuration.

F. Electrical Power:

Input: 100 to 240 V AC, 50/60 Hz, auto-switching.

Supply: Appliance must be configurable for multiple power supplies that may be replaced without the need to power down (hot-swappable).

Maximum Power Consumption: No greater than 2200W. G. System Certifications:

UL/USA.

Electromagnetic Emissions Certifications:

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.

Electromagnetic Immunity Standards:

EN 55024.

EN 61000-6-1.

EN 50130-4.

Safety Standards:

UL/CSA/IEC/EN 60950-1.

2.3 NETWORK VIDEO RECORDERS

A. Basis of Design Product: Avigilon HD NVR5 Premium 432 GB.

B. System Design:

Drive Configuration:

Video Storage: RAID 60: Up to 28 x 3.5” hot-swappable.

Operating System: 2 x 480 GB M.2 SSB Drives, RAID 1

Storage Capacity: 64 TB effective when configured with RAID 6.

Storage Capacity: 160 TB effective when configured with RAID 6.

Storage Capacity: 224 TB effective when configured with RAID 60.

Storage Capacity: 432 TB effective when configured with RAID 60.

Operating System: Microsoft Windows Server 2019 LTSC-16 Core.

Processor: 2×Intel® 8-core Xeon®

RAM: 8×8 GB DDR4

Networking: 2×10GbE SFP+ ports 4×1GbERJ-45ports

Power Supply: Dual(1+1)1000W redundant

Video Output: VGA.

Mounting: 2U rack mount chassis.

Operational Range:

Temperature: 10 degrees C to 35 degrees C [50F to 95F].

Relative Humidity: 8-90 percent (non-condensing), 28C max dew point.

Altitude: 3048 meters [10,000 ft].

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 shall 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.

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 VASS System shall 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 VASS System shall be integrated where appropriate with the following associated security subsystems:

F. PACS:

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.

Record cameras on a 24 hours basis.

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.

IDS:

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.

Record cameras on a 24 hours basis.

Be programmed to go into an alarm state when an IDS device is put into an alarm state, and notify the PACS.

Security Access Detection:

Provide full coverage of all vehicle and lobby entrance screening areas utilizing a fixed color camera.

Record cameras on a 24 hours basis.

The VASS System shall have facial recognition software to assist in identifying individuals for current and future purposes.

EPPS:

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.

Record cameras on a 24 hours basis.

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 VASS System shall be comprised of the following components:

Cameras
Lenses
Video Display Equipment
Camera Housings and Mounts
Controlling Equipment
Recording Devices
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 shall 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 VASS 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.
6. The Contractor shall return all removed cameras and security camera equipment to the COR during each demolition phase of work.

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 shall 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. Video Encoder/Decoder

Install the Video Encoder/Decoder per design and construction documents, and as specified by the OEM.

Connect analog camera inputs to video encoder.

Connect network camera to video decoder.

Connect video encoder to VASS network.

Connect video decoder to video matrix, DVR, and monitor.

Connect unit to AC power (UPS).

Configure the video encoder/decoder per manufacturer’s recommendation and project requirements.

O. Video Server:

Install the video server per design and construction documents, and as specified by the OEM.

Connect video server to AC power (UPS).

Connect to VASS network.

Install operating system and Video Management Software.

Provide Video Management Software programming per VA guidance and the requirements provided by the Owner. Programming shall include:

Camera names

Screen views

Camera recording schedules (continuous and event) driven recording.

Events include alarms from other systems (sensors), manual input, and video motion detection.

Video detection zones for each camera requiring video motion detection

Alarm interface

Alarm outputs

GUI maps, views, icons and actions

PTZ controls (presets, time schedules for privacy zones)

Reports

P. Video Recording Equipment:

Install the video recording equipment as shown in the design and construction documents, and as specified by the OEM.

Connect video signal inputs and outputs as shown and specified.

Connect alarm signal inputs and outputs as shown and specified.

Connect video recording equipment to AC power.

Program the video recording equipment;

Recording schedules

Camera caption

Q. Video Signal Equipment:

Install the video signal equipment as shown in the design and construction documents, and as specified by the OEM.

Connect video or signal inputs and outputs as shown and specified.

Terminate video inputs as required.

Connect alarm signal inputs and outputs as required.

Connect control signal inputs and outputs as required

Connect electrically powered equipment to AC power.

3.3 EXAMINATION

A. Verification of Conditions: Do not begin installation until substrates have been properly prepared.

B. Evaluation and Assessment: If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.4 PREPARATION

A. Surface Preparation: Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.5 ADJUSTING

A. Fine Tuning: Perform field software changes after initial programming session to “fine tune” operating parameters and sequence of operations based on any revisions to Owner’s operating requirements.

3.6 CLOSEOUT

A. Demonstration:

Demonstrate administration and operation of devices described by this section.

Demonstrate how to authorize users and applications to operate and configure installed devices.

Demonstrate how an authorized user can gain access to and make changes to configuration.

Demonstrate how to operate functionality configured for this project as defined by configuration punch list.

3.6 SYSTEM START-UP

A. Test equipment and configure system in accordance with instructions provided by the manufacturer prior to installation.

B. Configure equipment requiring users to log on using a password with user/site-specific credentials. Default passwords are not acceptable and must be configured prior to project closeout.

C. Provide products with the latest and most up-to-date firmware by the manufacturer or provide firmware of a version specified by the provider of the Video Management Application (VMA) or Network Video Recorder (NVR).

D. The Contractor shall not apply power to the VASS System until the following items have been completed:

VASS System equipment items and have been set up in accordance with manufacturer's instructions.

A visual inspection of the VASS System has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.

System wiring has been tested and verified as correctly connected as indicated.

All system grounding and transient protection systems have been verified as installed and connected as indicated.

Power supplies to be connected to the VASS System have been verified as the correct voltage, phasing, and frequency as indicated.

E. Coordinate the startup and contractor testing schedules with the Contracting Officer’s Representative. Provide a minimum of 7 days prior notice.

F. 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.

3.7 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 VASS System; and are approved by the Contracting Officer.

B. The Contractor shall 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.

3.8 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 for four hours to instruct VA personnel in operation and maintenance of units.

---END---

SECTION 28 23 20
VIDEO MANAGEMNT SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide and install a complete Network Video recorder as part of the Video Surveillance System, which is identified as the Video Assessment and Surveillance System hereinafter referred to as the VASS System as specified in this section.

B. This Section includes Video Management System.

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 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage

D. Section 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables

E. 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.

F. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.

G. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.

H. Section 28 05 28.33 - CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND

I. SECURITY. Requirements for infrastructure.

J. Section 28 23 00 VIDEO SURVEILLANCE

K. Section 28 23 20 VIDEO MANAGEMENT SYSTEM

L. Section 28 23 40 VIDEO IP CAMERAS

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate with Owner or Owner’s representative regarding network configuration and estimated throughput utilization prior to performing network connections.

B. Sequencing / Scheduling: Provide to Owner or Owner’s representative a schedule and list of participants required to attend coordination and progress update meetings.

1. Owner representative(s) for Facilities Management, Information Technology (IT) Services, and Security Management.
2. General Contractor.
3. Project Manager.
4. Manufacturer’s Representative.
5. Project Architect.
6. Project Engineer.
7. Security Consultant.

1.4 INFORMATIONAL SUBMITTALS

A. Submit under provisions of Section 01 33 23.

B. Product Data: Manufacturer's product information and data sheets for each product specified in this section, including:
   1. Substrate preparation instructions and recommendations
   2. Installation means and methods.
   3. Recommendations and requirements for proper storage and handling.

C. Shop Drawings:
   1. Submit Manufacturer’s approved shop drawings detailing the section and elevation views of each product to be installed.
   2. Coordinate with locations listed on Contract Drawings.

D. Warranty Information:
   1. Submit confirmation and details of manufacturer’s warranty, extended
   2. warranty, and replacement policies.

E. System Support Resources:
   1. Submit a list of available manufacturers providing fee based professional services available to the Contractor or Owner, including but not limited to the following:
      a. Training.
      b. Installation.
      c. Commissioning.
      d. Remote diagnostics and integration with 3rd party software and hardware systems.

1.5 CLOSEOUT SUBMITTALS

A. Supply licensing and registration information for all software, hardware, firmware, operational, and administrative licenses.

B. Supply network configuration backup files, restoration application and instructions.

1.6 WARRANTY

A. Manufacturer Warranty: Provide manufacturer’s warranty covering parts and labor costs to repair or replace part that fail to perform.
   1. Warranty Period: Parts and labor warranty for 36 months from date of Substantial Completion or date of purchase, whichever comes first.
   2. Service During Warranty: Provide direct support to Owner via phone and email, including access to training and education in the form of documents, videos and other materials via the internet.

1.7 QUALITY ASSURANCE

A. The Contractor shall be responsible for providing, installing, and the operation of the VASS 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 three (3) 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 (VASS) 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 shall 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 VASS. 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 4 hours 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 COR 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 shall 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 shall render satisfactory service to this installation eight hours of receipt of

notification that service is needed. Submit name and address of service organizations.

H. Installers:

1. Performs Network Video Recorder (NVR) installation, configuration, setup, programming and related work employing authorized integrators/electronic technicians certified by manufacturer.
2. Certification for authorized integrators/electronic technicians shall include, at a minimum, installation and service of equipment provided.

1.8 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):

330-09 Electrical 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 Commission (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):

70-2017 Article 780-National Electrical Code

G. Federal Information Processing Standard (FIPS):

140-2-02 Security Requirements for Cryptographic Modules

H. Underwriters Laboratories, Inc. (UL):

983-06 Standard for Surveillance Camera Units

3044-01 Standard for Surveillance Closed Circuit Television Equipment

1.9 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. To connecting raceways, cables, wireways, cable trays, and busways shall 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.

1.10 WARRANTY OF CONSTRUCTION

A. Warrant VASS 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 MANUFACTURERS

A. Basis of Design Manufacturer: Avigilon.
   1. Website: www.avigilon.com.
B. Substitution Limitations: Submit substitution requests.
C. Source Restrictions: Supplier to provide a fully integrated surveillance system consisting of fixed position and movable network cameras and the following components obtained from a single source and provided by a single manufacturer:
   1. Video Management System.
   2. Video Management System Interfaces.
   3. Storage Appliances for Electronic Safety and Security.
   4. Video Surveillance Positioning Equipment.
   5. Video Surveillance Sensors.
   6. Access Control Software and Database Management.

2.2 NETWORK VIDEO MANAGEMENT SOFTWARE (NVMS)

A. Description: Provide workstations with a simplified screen layout, intuitive controls, and customizable features that improve multi-person interactions, and include the following features:
   1. Video analytics and artificial intelligence (AI) capabilities, including appearance search, analytic event rule triggers, and unusual motion detection technology.
   2. Forensic search capabilities with bookmark, event, alarm and thumbnail search options.
   3. Light duty web browser interface allowing for the viewing of video and events, as well as the ability to run maintenance reports and perform maintenance functions such as firmware updates.
   4. Easy integration with leading camera and hardware manufacturers.
   5. Allows monitoring of live and recorded video via both OIS and Android Smart Devices.
   6. License Plate Recognition (LPR) analytics with multiple watchlists.
   7. Receives and acts on access control system door events, hardware input events, and access grants.
   8. Enables unlocking doors and activating digital outputs directly from a camera view.
   9. Identity search and identity verification using access control credentials to compare against recorded and live video respectively.

B. System: Provide a scalable NVMS solution with the following capabilities:
   1. 100 servers per site.
   2. 300 cameras per server.
   3. 10,000 cameras per site.
   4. Unlimited client licenses.

C. Basis of Design Product: Subject to compliance with requirements, provide Avigilon Control Center Enterprise - Version 7.0 by Avigilon.

2.3 NETWORK VIDEO MANAGEMENT SOFTWARE (NVMS)

A. Description: Provide workstations with a simplified screen layout, intuitive controls, and customizable features that improve multi-person interactions, and include the following features:
   1. Video analytics capabilities, including analytic event rule triggers and unusual motion detection technology.

2. Forensic search capabilities with bookmark, event, and thumbnail search options.
3. Easy integration with leading camera and hardware manufacturers.
4. Allows monitoring of live and recorded video over wireless IP networks from Apple or Android mobile devices.
5. Receives and acts on access control system door events, hardware input events, and access grants.
6. Enables unlocking doors and activating digital outputs directly from a camera view.
7. Identity search and identity verification using access control credentials to compare against recorded and live video respectively.

B. Provide a scalable NVMS system solution with the following capabilities:
1. 1 server per site.
2. 75 cameras per server.
3. 75 cameras per site.
4. 10 concurrent client-to-site connections.

C. Basis of Design Product: Subject to compliance with requirements, provide Avigilon Control Center Standard - Version 7.0 by Avigilon.

2.4 NETWORK VIDEO MANAGEMENT SOFTWARE (NVMS)

A. Description: Provide workstations with a simplified screen layout, intuitive controls, and customizable features that improve multi-person interactions, and include the following features:
1. Video analytics capabilities, including unusual motion detection technology.
2. Forensic search capabilities with bookmark, event, and thumbnail search options.
3. Easy integration with leading camera and hardware manufacturers.
4. Allows monitoring of live and recorded video over wireless IP networks from Apple or Android mobile devices.

2.5 NETWORK VIDEO MANAGEMENT SOFTWARE (NVMS) FUNCTIONALITY

A. General: Provide an NVMS software application that can be installed on any open platform hardware and does not require hardware multiplexer or time-division technology for video or audio.
1. Recording Storage Capacity: Expandable without additional licenses.
2. Video Decompression: Decompresses H.264 video through Owner supplied graphics processing unit (GPU).

3. The NVMS server and client software applications can be installed and run on same computer or on separate computers.
4. Languages: Provide software with versions for the following languages:
   a. English
5. Secure Transmission: Securely sends video and audio data by transmitting commands and control data via TCP/IP using cryptographic keys based on SSL/TLS to prevent eavesdropping or tampering.
6. Device Connections: Support the recording and management of video and audio sources through use of industry standard protocols, including the following:
   a. ONVIF Profile S and/or Profile T.
   b. Select 3rd party proprietary device APIs.
7. De-warping: Supports de-warping of live and recorded video from the following devices:
   a. Avigilon H4 Fisheye Cameras.
   b. Supported cameras fitted with an Immervision Panomorph lens.
   c. From cameras with a fixed fisheye lens, including but not limited to the Oncam Grandeye Evolution line of cameras.

B. Alarms and Events: Provide the ability to configure and manage alarms and events with the following capabilities:
1. Defines event triggers that are configured to result in an alarm.
2. Generates alarms based on the following event types:
   a. Detect events that occur within a camera's field of view.
   b. Detect presence of persons within a sensor's range.
   c. Detect if video or audio signal is lost and alert system administrator.
   d. Door activity detected by an access control application.
   e. Notify users of system errors.
   f. Receive alarms from third party systems (access control, etc.) and configured to be monitored.
   g. Support receiving digital input triggers and triggering digital outputs from:
      1) An input/output board.
      2) Supported IP camera, encoder or sensor.
      3) Integrated systems, including POS.
3. Receives events from devices through ONVIF driver.

4. Configure rules to trigger specific video operations.
5. Supports receiving Simple Network Management Protocol (SNMP) messages from servers and alert users.
6. Customizes and forwards alarm and event notifications to the following:
   a. Users logged into client application.
   b. Users logged into mobile application.
   c. Configured email addresses.
   d. External entities and third-party software, such as central monitoring stations and call centers.
7. Escalates alarms from one user or group to another if alarm is unacknowledged for a preset duration.
8. Configures email notifications to the following:
   a. Notify users and system administrators when an event or system health error occurs.
   b. Schedule when email notifications are sent.
   c. Include camera images in email notifications.
9. Configures Central Station Notifications to the following:
   a. Notify a central station monitoring service when an event or system health error occurs.
   b. Include video clips and/or camera images with camera motion, analytic or digital input events.
   c. Optionally use ANSI/SIA DC-09-2013 standard event notification format
10. Provides ability to send central monitoring stations periodic heartbeat messages, or regular notification to confirm system connection and that there are no events of note.
11. Arms or Disarms events and alarms based on a user configurable schedule or specific digital input state.

C. Event Triggers: Assign actions in response to specific event triggers. Response actions include the following:
   1. User Notification Actions:
      a. Display on-screen message.
      b. Send an email.
      c. Send notification to central monitoring station.
      d. Play a sound.
   2. Monitoring Actions:

a. Start live streaming video.
b. Create bookmark.
c. Open a saved view.
d. Start live streaming on a virtual matrix monitor.
e. Open a map on a virtual matrix monitor.
f. Open a web page on a virtual matrix monitor.

3. Device Actions:
   a. Reboot camera.
   b. Activate digital output.
   c. Deactivate digital output.
4. PTZ Actions:
   a. Go to Preset.
   b. Go to Home Preset.
   c. Run a Pattern.
   d. Set Auxiliary.
   e. Clear Auxiliary.
5. Alarm actions:
   a. Trigger an alarm.
   b. Acknowledge an alarm.
6. Supports conditional event triggers based on selected digital input status.
7. Manually triggers digital output through the following:
   a. A pre-configured software control.
   b. A physical trigger that is connected to a supported input/output device.

D. Video Analytics: Provide configurable classified object detection for each device with self-learning video analytics capabilities.
1. Allows users to connect individual video sources to analytics appliance channels.
2. Allows users to configure events based on classified object motion detection.
3. Allows configured video analytics events to be used as alarm and rule triggers.
4. Allows users to mark classified objects as a true or false detection.
   a. Transmits collected data to video source to improve accuracy of video analytics device.

5. Support the following video analytic event types when captured by supported cameras:
   a. Objects in area.
   b. Object loitering.
   c. Objects crossing defined line.
   d. Object appears or enters area.
   e. Object not present in area.
   f. Objects enter area.
   g. Objects leave area.
   h. Object stops in area.
   i. Anticipated direction of travel is violated.
   j. Tampering & Scene dramatically changes in an unexpected fashion.

E. Focus of Attention: Provide functionality which automatically focuses the operator’s attention during critical events.
   1. Event Handling:
      a. Classified object motion detection.
      b. Unusual motion.
      c. Rule based video analytic events.
      d. Alarm events.
   2. Filtering:
      a. Event types: Provide a user interface which allows for inclusion or exclusion of unnecessary event types.
      b. Frequent event handling: Support the identification and exclusion of frequently recurring events on a per-camera and per event basis.

F. License Plate Recognition (LPR): Support operation of a license plate recognition system that include:
   1. Defines region of an image where license plate detection is performed.
   2. Stores detected license plates with video data.
   3. Support multiple watch lists that are used to create events or alarms when specific license plates are detected.
   4. Defines the longest retention period for license plate detections for privacy compliance.

G. Signal Processing and Compression: Supports storage and processing of video and audio as follows:
   1. Natively records camera signals with no transcoding.

2. Supports industry standard video compression formats, including, but not limited to, the following:
   a. JPEG2000.
   b. MJPEG.
   c. MPEG-4.
   d. H.264.
   e. H.265.
3. Synchronizes audio and video regardless of frame-rate, resolution or bitrate.

H. Dynamic Video Stream Management: Performs dynamic video stream management as follows:
1. Provide Avigilon High Definition Stream Management (HDSM)™.
2. Reduces system bandwidth and storage usage by only transmitting video to client as determined by the Owner.
3. The client communicates the maximum monitor resolution to the server and the server acts as a video proxy and stream the required video resolution.
4. Tile multi-megapixel videos streams and only transmit requested portion of video stream to the client.
5. Extend recorded video storage by dynamically reducing quality of recorded video over time so video is still viable but uses less storage.
   a. Reduces JPEG and JPEG2000 video image rate to one half or one quarter of original image rate.
   b. Record both a high-quality stream and a low-quality stream, discarding high quality streams after a set amount of time determined by the Owner.
6. Allow availability of dynamic video stream management to local users, remote users, and mobile devices.

I. Event Logging: Maintain an event log and allows users to use log events as triggers for specific event actions. Logged events include the following:
1. Server events:
   a. Server application starting up.
   b. Server application shutting down.
   c. Server application terminated unexpectedly.
   d. Server application low on resources.

e. Server application installation error.
f. License expires soon.
g. License expired.
h. Database error.
i. Data initialization error.
j. Data volume failed.
k. Data volume recovered.
l. Data volume size reduced.
m. Data write error.
n. Data upgrade started.
o. Data upgrade completed.
p. Data upgrade failed.
q. Data recovery started.
r. Data recovery completed.
s. Data recovery failed.
t. Bookmark save failed.
u. Network connection found.
v. Network connection lost.
w. Email send error.
x. Server hardware event.
y. Archiving started.
z. Archiving completed.
aa. Archiving interrupted.
bb. Server connection lost.
cc. Analytics server queue full.Analytics server connection lost.
dd. LPR service restarted.
ee. LPR service terminated unexpectedly.

2. Device Events:
   a. Connection created.
   b. Connection removed.
   c. Connection created to standby server.
   d. Connection removed from standby server.
   e. Connection failure.
   f. Device failed.
   g. Connection restored.
   h. Network packet loss unacceptable.
   i. Network packet loss acceptable.

j. Motion detection started.
k. Motion detection ended.
l. Video analytics event started.
m. Video analytics event ended.
n. Tampering detected.
o. Recording started.
p. Recording ended.
q. Recording interrupted.
r. Recording resumed.
s. Digital input activated.
t. Digital input deactivated.
u. Firmware upgrade started.
v. Firmware upgrade completed.
w. Firmware upgrade failed.
x. Obsolete firmware detected.
y. User-defined event started.
z. User-defined event ended.
aa. Presence detected.
bb. Presence ended.
cc. Presence dwell time exceeded.
dd. Presence dwell time ended.

3. User Events:
   a. User login.
   b. User logout.
   c. Server setting changed.
   d. Site setting changed.
   e. Device setting changed.
   f. Device connected.
   g. Device disconnected.
   h. Digital output triggered.
   i. Bookmark added.
   j. Bookmark updated.
   k. Bookmark deleted.
   l. PTZ moved.
   m. PTZ idle.
   n. Export performed.
   o. Speaker activated.

p. Speaker deactivated.
q. Virtual matrix monitor opened.
r. Map added.
s. Map updated.
t. Map deleted.
u. View added.
v. View updated.
w. View deleted.
x. Web Page added.
y. Web Page updated.
z. Web page deleted.
aa. Site View updated.
bb. Custom keyboard command triggered.

4. Alarm Events: Alarm acknowledged.
   a. Alarm auto acknowledged.
   b. Alarm triggered.
   c. Alarm assigned.
   d. Alarm unassigned.
   e. Alarm purged.
5. POS Transaction Events: POS transaction started.
   a. POS transaction ended.
   b. POS transaction exception.
6. License Plate Recognition Events: License plate detection started.
   a. License plate detection ended.
   b. License plate watchlist match.
7. Access Control Events: Door access denied.
   a. Door access granted.
   b. Door closed.
   c. Door forced.
   d. Forced door closed.
   e. Door held open.
   f. Held door closed.
   g. Door opened.
   h. Door duress.
   i. Door request to exit.
   j. Certificate validation failed.
   k. Input activated.

l. Input deactivated.
m. Input fault detected.
n. Input fault cleared.

J. Storage Management: Allow management of recorded content with the following capabilities:
1. Multiple levels of video storage management:
a. Tier 1: Video recorded directly on local server.
b. Tier 2: Recorded video continuously archived to long term storage.
c. Ad Hoc: Recorded video on local server can be archived on-demand to administrator-defined storage location.
2. Support for the following video and audio recording options:
a. Manually triggered recording.
b. Pre-event and post-event recording options.
c. Reference frame recording option in absence of events.
d. Recording schedules that can be defined individually for each video source, including, but not limited to continuous recording.
e. Event based recording that is triggered by the following:
1) Pixel or classified object motion.
2) Digital inputs.
3) POS transactions.
4) Alarms.
5) License plates recognition.
a) Customized daily and weekly schedule.

K. Backup and Archiving:
1. Schedules archive of recorded video with associated events to a local folder or mapped network drive.
2. Backs-up settings and configuration for each server, including the following:
a. Site settings; such as users/groups, maps and web pages.
b. Server settings, including device connections.
c. Encrypts backup to maintain security of information.
3. Restores backed-up settings and configurations to a new or replacement server in a site.

2.6 NETWORK VIDEO MANAGEMENT SOFTWARE (NVMS) CREDENTIALS AND SECURITY

A. Authentication: System must require users to be authenticated prior to granting access to the NVMS.

B. Customization: Provide access rights that can be tailored to each user or group of users. Access rights include the following:

1. View live images:
   a. Use PTZ controls.
   b. Lock PTZ controls.
   c. Trigger manual recording.
   d. Trigger digital outputs.
   e. Broadcast to speakers.
2. View recorded images:
   a. Export images.
   b. Archive images.
   c. Create teach markers.
3. Manage saved views.
4. Manage maps.
5. Manage web pages.
6. Manage virtual matrix monitors.
7. Initiate collaboration sessions.
8. Manage user sessions.
9. Listen to microphones.
10. Setup cameras:
    a. Setup general settings.
    b. Setup network settings.
    c. Setup image and display settings.
    d. Setup compression and image rate settings.
    e. Setup image dimension settings.
    f. Setup motion detection settings.
    g. Setup privacy zone settings.
    h. Setup manual recording settings.
    i. Setup digital input & output settings.
    j. Setup microphone settings.
    k. Setup speaker settings.
    l. Setup analytics settings.
    m. Setup teach by example.
11. Setup sites:
    a. Setup name.
    b. Manage site.
    c. Setup site view.

d. Setup user and group settings.
e. Setup Active Directory Synchronization.
f. Setup Corporate Hierarchy.
g. Setup alarm management settings.
h. Setup POS transaction settings.
i. Setup LPR settings.
j. Setup email settings.
k. Setup rule engine settings.
l. View site logs.
m. Connect and disconnect devices.
n. View Site health.

12. Setup servers:
    a. Manage server.
    b. Setup schedule settings.
    c. Setup recording and bandwidth settings.
    d. Setup Storage Management.
    e. Backup settings.
    f. Setup server analytics.

C. Access Ranking: Provide the ability to rank access rights based on a user’s position within a configured hierarchy.
1. Ranked users may only administer changes to users and groups that are subordinate in rank.
2. Corporate hierarchy can be used to enforce authority of a parent site over user and group settings of one or more child sites.

D. Hierarchical Site families: Allow for the creation and management of parent-child relationships among sites.
1. Child sites may be connected to an appropriately licensed parent site.
2. Parent site will have control over user permission and information of a child site.
3. If a user has access to parent site, child sites are automatically discovered.

E. Credentials: Allow multiple credentials for system access, including but not limited to:
1. Validation of user credentials and password entered into NVMS user database where user passwords meet a configurable strength requirement.

2. Two-factor authentication of users in the NVMS using time-based One-Time Password (TOTP) and a supported mobile authenticator application used to generate a code on Apple and Android mobile devices.
3. Importing members of Active Directory groups as users in NVMS. Automatically synchronizes changes made to members in Active Directory with NVMS.
   a. Directly adds users imported from Active Directory to existing permission groups.
4. Importing roles from Access Control Manager application.
   a. Automatically synchronizes changes made to roles in the access control application with NVMS.
   b. Directly adds users imported from the access control application to existing permission groups.
   c. Imported users with appropriate privileges will be able to control doors within NVMS.
5. Windows credentials.

F. Security: Manage and personalize user access as follows:
1. Allow administrators to override user access to an NVR if there are insufficient licenses.
2. Allow administrators to restrict user access to any video recorded earlier than the current login session
3. Allow administrators to restrict user access to high resolution recorded video for privacy compliance.
4. Allow administrators to restrict specific user’s access to search features that use what is considered personally identifiable information (PII) for privacy compliance, such as license plates and physical appearance.
5. Allow administrators to define rules that disable video or audio streams from specific devices for privacy compliance.
6. Set client software to automatically log in to multiple sites.
7. Set client software to automatically log out of all sites when application is left idle.
8. Set client software to automatically save and restore last window layout.
9. Set maximum bandwidth of streamed video data from server to client application.

10. Record and permit reporting on user activity including log-in, log-out events, video export requests, live video viewing by camera, access to recorded video by camera.

2.7 NETWORK VIDEO MANAGEMENT SOFTWARE (NVMS) COMPATIBILITY

A. Server Application Compatibility: Provide software compatible with the following server applications:
   1. Avigilon Control Center Server.
   2. ACC Analytics Service.
   3. ACC Web Endpoint.
   4. ACC LPR plug-in (V2).

B. Desktop Client Software Compatibility: Provide software compatible with the following client applications:
   1. ACC Client.
   2. ACC Virtual Matrix.
   3. Avigilon Player.

C. Mobile Client Software Compatibility: Provide software compatible with the following mobile device applications:
   1. Unity Mobile App.
      a. Android version 5.x or later.
      b. iPad, iPhone and iPod touch with iOS 10 or later.

D. Monitoring Sources: Monitors video and audio sources from the following sources:
   1. Avigilon cameras/encoders.
      a. Avigilon H6 Pro H.264 Cameras.
      b. Avigilon H6 HD Cameras with Self- Learning Video Analytics.
      c. Avigilon H5 Multi-sensor Cameras.
      d. Avigilon H5 Thermal Cameras.
      e. Avigilon H4 Video Intercom Cameras.
      f. Avigilon H5 Fisheye Cameras.
      g. Avigilon H6 SL Cameras.
      h. Avigilon H6 Mini Dome Cameras.
      i. Avigilon H5 PTZ / IR PTZ Cameras.
      j. Avigilon Halo Smart Sensor
   2. Arecont cameras.
   3. Axis cameras/encoders.
   4. Bosch cameras/encoders.
   5. IQInvision cameras.

6. Mobotix cameras.
7. ONVIF Profile S, T and G conformant cameras and encoders.
8. Panasonic cameras/encoders.
9. Pelco cameras.
10. Rialto Video Analytics Appliances.
11. Hanwua cameras/encoders.
12. VideoIQ cameras/encoders.

E. Device Discovery and Identification: Detects and systems on network by the following methods:
1. Automatic: Servers, video and audio sources that are connected to same network as client are automatically discovered.
2. Search: Servers, video and audio sources running on a different network segment than client can be discovered by searching for device's IP address or hostname.
3. Parent to Child: By logging into a parent site automatically discovers configured children sites.
4. Manual Detection: Allows manually discovered server instances, video and audio sources, and access control appliances to be visible to users of a single client workstation.
5. Network Settings: Identical for all users of a single client workstation.
6. Third Party Integration Requirements: Support software level integration with third-party applications using NVMS software development kit (SDK) or Application Programming Interface (API) and provide the following features to the third-party software:
   a. Connection: Auto-discover servers, login and authentication.
   b. Video Streaming: Auto-discover connected cameras, live and recorded video (RAW or MJPEG format; H.264 only to Windows applications).
   c. Video Overlays: Display overlays over streaming video (classified object bounding boxes, motion detection, camera name/location, timestamp).
   d. PTZ Control: Control PTZ cameras (pan/tilt, zoom, presets, patterns, iris and lock PTZ).
   e. Audio Streaming: Stream audio from third-party system to an NVMS camera (camera to third-party system only to Windows application).

f. Alarm Management: List, query, trigger, assign, acknowledge & purge alarms.
g. Event Management: List, query, subscribe for notification on events (camera, server, administrative, digital I/O, video analytics, license plate recognition, point of sale).
h. Bookmark Management: List, query, create, delete.
i. Digital Output: Trigger digital outputs.
j. Archive/Export: Trigger archive or export in NVMS native export video format or generic video/image formats including AVI, PNG, TIFF, JPEG.

7. Support integration with the following systems:
   a. Avigilon Access Control Manager.
   b. DSX Access Systems WinDSX.
   c. RS2 AccessIT! Universal.NET.
   d. Avigilon Control Center License Plate Recognition (V2 LPR plug-in).
   e. AMAG Symmetry.
   f. Gallagher Command Centre.
   g. Jacques IP Intercom.
   h. Lenel OnGuard.
   i. Paxton Net2.
   j. S2 Netbox.
   k. Software House CCure 9000.
   l. Vingtor-Stentofon AlphaCom.

F. Pan-Tilt-Zoom Configuration and Control: Enables and configures PTZ control on RS-485 interface of a video source.
   1. Supports the following PTZ protocols:
      a. American Dynamics Sensormatic.
      b. AXSYS.
      c. AXSYS DCU.
      d. Ernitec ERNA.
      e. Honeywell Diamond.
      f. JVC JCBP.
      g. Kalatel ASCII.
      h. Pelco D.
      i. Pelco P.
      j. TEB Ligne.

k. Vicon extended.
l. Vicon normal.
m. Videotec Legacy.
n. Videotec MACRO.

2. Supports pan-tilt-zoom (PTZ) cameras and provides the following:
   a. Supports controlling mechanical PTZ, iris and focus as well as setting presets and patterns.
   b. Provides ability to name PTZ presets.
   c. Supports ability to create PTZ guard tours by combining a set number of presets that are run in order or random sequence.
   d. Supports ability to center a PTZ camera’s field of view by
   e. clicking anywhere on video image.
   f. Supports ability to click and drag to define an area for PTZ camera to mechanically zoom and center on.
   g. Supports controlling mechanical PTZ camera on-screen display and auxiliary controls.
   h. Support selecting digital image defog levels where supported.
   i. Support selecting camera day/night operation mode where supported.
   j. Supports locking PTZ controls.
   k. Permits a user with a higher rank to override a PTZ control lock.
   l. Supports using a USB joystick to control PTZ functions.

2.8 NETWORK VIDEO MANAGEMENT SOFTWARE (NVMS) USER INTERFACE

A. General: Provide a graphic user interface with the following functionality:
   1. A system tree of video sources in video monitoring tab.
      a. The system tree display can be configured.
      b. The system tree can be organized into virtual folders that are represented as branches within site.
      c. Users can be granted access to individual items or entire folders within system tree.
      d. Maps, saved views and web pages may be viewed. Client adjustable light and dark theming with settings specific to each application and workstation.
   2. Support for collaborative application window sharing within in a joint session among multiple users.
   3. Support for an unlimited number of monitors used for monitoring video and audio streams connected to a single workstation.

a. Displays all video sources connected to system.
b. Support ability to drag and drop items from system tree into video monitoring area.
c. Support monitoring live and recorded video and audio streams simultaneously on same monitor.
d. Support viewing same live or recorded video stream at different zoom levels and areas of interest.
e. Support ability to switch from live to recorded video on demand for an instant replay of recently recorded video.
f. Support creation of unlimited views with unique layouts of video streams.
g. Support ability to toggle between tiled and full-screen view.
h. Support ability to save configured display setting.
i. Support ability to cycle through views (guard tour) based on a specified interval.
j. Supports live or recorded video monitoring of 1 to 64 video streams simultaneously on a single monitor.
k. Supports displaying videos streams in the following standard layouts:
   1) Full Screen.
   2) 2 x 2.
   3) 3 x 3.
   4) 4 x 4.
   5) 5 x 5.
   6) 6 x 6.
   7) 8 x 8.
   8) 1 + 5.
   9) 1 + 7.
   10) 1 + 12.
   11) 2 + 8.

4. Provides tools to build custom video monitoring layouts.

B. Video Parameter Controls: Support modifications to the following image quality and image rate parameters for each individual video source:
1. Video streaming format.
2. System optimized recording profile or manual configuration.
3. Keyframe interval.
4. Secondary stream for live viewing.

5. Configure video streaming at a lower image rate when scene is idle.
6. Customize primary and secondary stream on supported cameras.

C. Camera Controls: Provide the ability to change the following supported video options at the client or video source:
1. Encrypt camera configuration data if supported by camera.
2. Camera passwords from client application.
3. Exposure, iris, IR filter, backlight compensation, gain, priority, sharpening, saturation, focus, and white balance settings for a video source.
4. Image dimensions for a video source.
5. Rotate image 90, 180 or 270 degrees within a video source.
6. Addition of multiple privacy zones within a video source to block areas from being viewed or recorded in image field of view.
7. Set a maximum duration for manually triggered recording within a video source.

D. Audio Controls: Provides ability to change input, output, gain and volume for an audio source.
1. Supports use of uni-directional and bi-directional audio.
2. Provides ability to link any audio source to any video source.
   a. Able to link multiple audio sources to a single video source.
   b. Able to link an audio source to many video sources.
3. Provides ability to synchronize audio and video on playback.
4. Supports ability to bias displayed video to a lower frame rate or lower image resolution if there is insufficient network bandwidth or processing power.
   a. Bias shall not affect video recording.
   b. Bias shall not affect video exports.
5. Supports ability to independently control if audio source is enabled for the user to monitor and if audio source is recorded with the video source.
6. Provides a Virtual Matrix application module supporting remote control of multiple monitor displays, including video walls. Displays simultaneous video streams on connected monitor displays from multiple sites.
7. Displays overlays on top of video images.

a. Auto-hiding functional overlays that changes depending on video streaming mode and device support. Functional overlays include, but are not limited to, the following:
   1) Button to manually trigger video recording / video recording indicator.
   2) Button to trigger digital output.
   3) Button to capture video snapshot.
   4) Button to close video stream.
   5) Button to reserve a portion of screen for alarm video. Button to enable audio.
   6) Button to display POS transactions.
   7) Button to maximize video display.
   8) Button to trigger single-camera search.
   9) Button to grant door access.
   10) Click classified object bounding box to initiate Appearance Search.
   11) PTZ controls.
b. Information overlays that include, but are not limited to, the following:
   1) Camera name.
   2) Camera location.
   3) Playback timestamp with option of displaying device time or local time.
   4) Live timestamp with option of displaying device time or local time.
   5) Recording indicator.
   6) Motion activity.
   7) Video analytics object detection activity with colored bounding boxes around moving objects classified as humans or vehicles.
   8) Video analytics unusual motion anomaly detection with colored bounding boxes indicating area of motion.
   9) Detected license plate.

8. Supports alarm management operations through video monitoring interface. Including but not limited to:
   a. Designated tab for reviewing alarms.
   b. Interface supports sequential viewing of alarms.
   c. Interface supports sorting of alarms by:

1) Priority.
2) Activation time.
3) Status.

d. Interface supports filtering alarms by status in the following priority:
1) Assigned to me.
2) Active alarms (unassigned).
3) Alarms assigned to others.
4) Acknowledged alarms.

e. Supports ability to assign alarms to user.

f. Supports ability to acknowledge alarms.

g. Supports ability to bookmark alarms.

h. Designate one or more regions in video display area for displaying video directly linked to triggered alarms or rules.
1) Supports ability to acknowledge alarms from designated video display area.

E. Site Mapping: Support mapping of the physical locations of cameras and other devices throughout surveillance system.

1. Provide maps with the ability to do the following:
a. Create a hierarchy of interlinked maps.
b. Drag and drop objects in system tree onto map.
c. Click and display objects from map.
d. Drag and drop a video source from map into video viewing area.
e. Display a preset area of selected video source.
f. Provide customizable map icons.
g. Highlight specific cameras when an alarm linked to camera is triggered.

2. Image Size: 3000px by 3000px or 9 MP, maximum.

3. File Formats: Maps may be created from the following file formats:
a. JPEG/JPG.
b. BMP.
c. PNG.
d. GIF.

F. Playback of Recorded Video and Audio: Support playback of recorded video and audio with the following features:

1. Forward and reverse playback of recorded content at variable speeds.

2. Recorded content plays back synchronously when signal sources are linked.
3. Playback of recorded video from archived long-term storage.
4. The ability to require dual authorization to access features and require specific user groups to request a second user authentication before recorded video may be displayed.
5. Provide the following methods for navigating recorded video:
   a. Selectable calendar.
   b. Horizontal, scrollable timeline:
      1) Timeline lists all displayed video sources.
      2) Timeline highlights motion and events in recorded video.
      3) Video archived to long term storage shall be identified on timeline.
      4) Supports a timeline that can display down to quarter second increments.
      5) Supports a timeline that can synchronize video displayed on multiple tabs to same point in time.
      6) Interface supports filtering unusual motion anomaly events on the timeline by rarity, duration and type.

G. Search of Recorded Video and Audio: Allow for searching of recorded content with the following functionality:
1. Support recorded video search with the following selectable parameters:
   a. Time.
   b. Date.
   c. Event type.
   d. Visual search based on a pre-defined image area, or image thumbnail:
      1) Thumbnails can be based on entire image region or a pre-selected area.
      2) Thumbnails can be stacked to support an automatic secondary search when looking at a large timespan of video.
   e. Pixel motion in user defined areas.
   f. Classified object motion detection in user defined areas on supported video analytics sources.
   g. Bookmarks.
   h. Video source.

i. Point of sale transactions.Alarm.
j. License plate detection events.

2. Support object appearance search across multiple cameras:
   a. Ability to search for a person or vehicle of interest in recorded video from multiple cameras in the current or alternative site to return possible matches.
      1) Automatically enhance person search by utilizing face characteristics to match similar people from supported cameras.
      2) Supported cameras with self-learning video analytics capabilities that are connected to an NVR with a supported GPU accessory should be able to return possible matches for search.
   b. Ability to initiate an appearance search of recorded video for similar persons or similar vehicles based on a specific user selected object in a video scene
   c. Ability to initiate an appearance search of recorded video by description:
      1) Using one or more personal characteristics: gender, age category (child vs adult), hair color, upper body color, lower body color.
   d. Ability to initiate search from recorded video in Client application or dedicated player.
   e. Supports reviewing search results and confirmation of correct matches.
   f. Supports editing search parameters including:
      1) Cameras included in search.
      2) Time range for search.
   g. Supports playback of search results, including:
      1) Recorded video associated with individual results.
      2) Sequential playback of recorded video associated with confirmed to be correct matches.
   h. Supports exporting video associated with results, including:
      1) Recorded video associated with one of more selected results.
      2) Recorded video associated with confirmed to be correct matches.
      3) Redacting video for privacy to blur the resulting video except for the objects selected in the results
   i. Supports creation of bookmarks for results, including:
      1) One or more selected results.

2) Confirmed to be correct matches.

H. Bookmarking:

1. Supports creating bookmarks for recorded video and audio. Bookmarks can be:
   a. Viewed from multiple sources.
   b. Displayed on timeline during playback.
   c. Used as a search criteria for recorded video and audio. Search criteria can include but are not limited to:
      1) Name.
      2) Description.
      3) Bookmark creator.
   d. Supports protecting a bookmark so associated video and audio data is never overwritten.
   e. Supports private bookmarks that are only visible to user who designated bookmark as private, and system administrator.

I. Media Exporting: Support the ability to export media and provide the following options:

1. Exports recorded video in the following formats:
   a. Native (AVE).
   b. JPEG.
   c. PNG.
   d. TIFF.
   e. AVI.
   f. Print.
2. Exports recorded audio in the following formats:
   a. WAV.
   b. Native (AVE).
   c. AVI.
3. Exports a still frame of video as displayed in video preview area:
   a. Native (AVE).
   b. JPEG.
   c. PNG.
   d. TIFF.
4. Native (AVE) format exported as follows:
   a. Digitally sign recorded video and audio using 256-bit encryption so video can be authenticated for evidentiary purposes.

b. Protect exported video with a password meeting configurable strength requirement.
c. Able to export video from one or multiple camera streams simultaneously.
d. Supports exporting multiple video segments from different spans of time.
e. Supports reviewing of exported or backed-up video and audio in a dedicated player.
f. Supports playback of exported clips in synchronized, sequential time.
g. Supports playback of multiple clips in continuous, sequential order.
h. Supports exporting of video in lower frame-rates than originally recorded.
i. Supports exporting of a designated area from camera’s recorded field of view.
j. Supports re-export into Native or other supported formats.
k. Provides a record of video source with the following metadata:
   1) Camera model.
   2) Firmware version.
   3) Location.
   4) MAC address.
   5) Serial number.
   6) Resolution.

J. Version Upgrade: Provide a process for upgrading versions:
1. Upgrading server software shall not require physical access to servers.
   a. Launch upgrades from client interface.
   b. All connected servers and clients shall receive a distribution of new version upgrade.
      1) The administrator can manually trigger upgrade of each server.
   c. The user shall be able to monitor upgrade progress from client interface.
2. Upgrading number of connected devices or upgrading to enterprise version only requires a change in license key.
3. Upgrade from one version to another occurs without having to uninstall application and previous version.

4. Automatically upgrade connected video or audio source device firmware if applicable.
5. Automatically prompt user to upgrade client application if it is out of date with respect to server software.

2.9 HARDWARE

A. Supported Applications:
1. Summary: Preload NVMS applications in the following Avigilon hardware:
   a. ACC Edge Solution (ES) HD Recorder.
   b. ACC ES Analytics Appliance.
   c. ACC ES 8-Port Appliance.
   d. Avigilon HD Video Appliance.
   e. Avigilon HD Network Video Recorder.
   f. Avigilon HD Network Video Recorder Workstation.

B. Owner Furnished, Contractor Installed (OFCI) Hardware:
1. Configure NVMS to run as a service to automatically start when server or workstation is powered on.
2. The NVMS allows users to monitor and administer system from:
   a. A single client application for monitoring live and recorded video and audio.
   b. A single window for administrating all system connections.
   c. A single tab for monitoring overall system health including:
      1) All sites connected in parent-child relationships.
      2) Any connected analytic appliances in the site.
      3) Any connected Access Control systems.
      4) Server-side License Plate Recognition processes.
      5) Server-side Analytic Service processes with peak load information.
      6) Ability to export health report to Portable Document Format (PDF).
   d. Each client with access to a local or distributed network.
3. The NVMS provides a maintenance log and audit trail of all system errors and events.
4. The NVMS provides multiple levels of system redundancy:Cluster and synchronize at least 100 servers into a unified site.
   1) In the event of a server failure, system can continue running and allow other servers to take over failed server’s tasks.

b. Centralized system administration:
   1) Site and server configuration details are replicated to each server in the site.
   2) Sites can be organized in a hierarchical parent-child relationship where parent can always control child site settings.
c. Connect a video or audio source to multiple servers to achieve redundant recording.
d. Create a failover connection for a video or audio source between servers in a site.

5. The NVMS provides the capability to replace malfunctioning video or audio sources with a new device and associate old recorded video with the new device.
6. The NVMS provides capability to rename all sites, servers, and video and audio sources.

C. Peripherals:
1. The NVMS provides ability to control client application using the following types of peripherals:
   a. A USB keyboard and/or mouse
   b. A USB joystick.
   c. A PTZ controller keyboard.

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 shall 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 VASS System shall 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 VASS 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.
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 VASS System shall have 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 VASS System shall be comprised of 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 shall 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 VASS 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.
6. The Contractor shall return all removed cameras and security camera equipment to the COR during each demolition phase of work.

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 shall 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. Video Encoder/Decoder
   1. Install the Video Encoder/Decoder per design and construction documents, and as specified by the OEM.
   2. Connect analog camera inputs to video encoder.
   3. Connect network camera to video decoder.
   4. Connect video encoder to VASS network.
   5. Connect video decoder to video matrix, DVR, and monitor.
   6. Connect unit to AC power (UPS).
   7. Configure the video encoder/decoder per manufacturer’s recommendation and project requirements.

O. 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 VASS 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)
      i. Reports

P. 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

Q. 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.

3.3 EXAMINATION

A. Verification of Conditions: Do not begin installation until substrates have been properly prepared.

B. Evaluation and Assessment: If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.4 PREPARATION

A. Surface Preparation: Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.5 ADJUSTING

A. Fine Tuning: Perform field software changes after initial programming session to “fine tune” operating parameters and sequence of operations based on any revisions to Owner’s operating requirements.

3.6 CLOSEOUT

A. Demonstration:
1. Demonstrate administration and operation of devices described by this section.
2. Demonstrate how to authorize users and applications to operate and configure installed devices.
3. Demonstrate how an authorized user can gain access to and make changes to configuration.
4. Demonstrate how to operate functionality configured for this project as defined by configuration punch list.

3.7 SYSTEM START-UP

A. Test equipment and configure system in accordance with instructions provided by the manufacturer prior to installation.

B. Configure equipment requiring users to log on using a password with user/site-specific credentials. Default passwords are not acceptable and must be configured prior to project closeout.

C. Provide products with the latest and most up-to-date firmware by the manufacturer or provide firmware of a version specified by the provider of the Video Management Application (VMA) or Network Video Recorder (NVR).

D. The Contractor shall not apply power to the VASS System until the following items have been completed:

1. VASS System equipment items and have been set up in accordance with manufacturer's instructions.
2. A visual inspection of the VASS 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 VASS System have been verified as the correct voltage, phasing, and frequency as indicated.

E. The Commissioning Agent shall observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Contracting Officer’s Representative and Commissioning Agent. Provide a minimum of 7 days prior notice.

F. 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.

3.8 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 VASS System; and are approved by the Contracting Officer.

B. The Contractor shall 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.

3.9 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 for four hours to instruct VA personnel in operation and maintenance of units.

---END---

SECTION 28 23 40

VIDEO IP CAMERAS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide and install a complete Network Video recorder as part of the Video Surveillance System, which is identified as the Video Assessment and Surveillance System hereinafter referred to as the VASS System as specified in this section.

B. This Section includes Video IP Cameras.

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 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.

D. Section 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.

E. 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.

F. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.

G. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.

H. Section 28 05 28.33 - CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.

I. Section 28 23 00 VIDEO SURVEILLANCE

J. Section 28 23 20 VIDEO MANAGEMENT SYSTEM

K. Section 28 23 40 VIDEO IP CAMERAS

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate with Owner or Owner’s representative regarding network configuration and estimated throughput utilization prior to performing network connections.

B. Sequencing / Scheduling: Provide to Owner or Owner’s representative a schedule and list of participants required to attend coordination and progress update meetings.
   1. Owner representative(s) for Facilities Management, Information Technology (IT) Services, and Security Management.
   2. General Contractor.
   3. Project Manager.
   4. Manufacturer’s Representative.
   5. Project Architect.
   6. Project Engineer.
   7. Security Consultant.

1.4 INFORMATIONAL SUBMITTALS

A. Submit under provisions of Section 01 33 23.
B. Product Data: Manufacturer's product information and data sheets for each product specified in this section, including:
   1. Substrate preparation instructions and recommendations
   2. Installation means and methods.
   3. Recommendations and requirements for proper storage and handling.
C. Shop Drawings:
   1. Submit Manufacturer’s approved shop drawings detailing the section and elevation views of each product to be installed.
   2. Coordinate with locations listed on Contract Drawings.
D. Warranty Information:
   1. Submit confirmation and details of manufacturer’s warranty, extended warranty, and replacement policies.
E. System Support Resources:
   1. Submit a list of available manufacturers providing fee based professional services available to the Contractor or Owner, including but not limited to the following:
      a. Training.
      b. Installation.
      c. Commissioning.
      d. Remote diagnostics and integration with 3rd party software and hardware systems.

1.5 CLOSEOUT SUBMITTALS

A. Supply licensing and registration information for all software, hardware, firmware, operational, and administrative licenses.

B. Supply network configuration backup files, restoration application and instructions.

1.6 WARRANTY

A. Manufacturer Warranty: Provide manufacturer’s warranty covering parts and labor costs to repair or replace part that fail to perform.
   1. Warranty Period: Parts and labor warranty for 36 months from date of Substantial Completion or date of purchase, whichever comes first.
   2. Service During Warranty: Provide direct support to Owner via phone and email, including access to training and education in the form of documents, videos and other materials via the internet.

1.7 QUALITY ASSURANCE

A. The Contractor shall be responsible for providing, installing, and the operation of the VASS 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.
   3. None of the new security surveillance cameras supplied by the contractor will be sourced from Chinese manufacturers in accordance

with the National Defense Authorization Act, or NDAA. Contractor to ensure no new cameras are refurbished cameras from China.

F. Contractor Qualification:

1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of three (3) 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 (VASS) 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 shall 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 VASS. 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 4 hours 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 COR 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 shall 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 shall render satisfactory service to this installation eight hours of receipt of notification that service is needed. Submit name and address of service organizations.

H. Installers:

1. Performs Network Video Recorder (NVR) installation, configuration, setup, programming and related work employing authorized integrators/electronic technicians certified by manufacturer.
2. Certification for authorized integrators/electronic technicians shall include, at a minimum, installation and service of equipment provided.

1.8 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):

330-09	Electrical 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 Commission (FCC):

E. (47 CFR 15) Part 15 Limitations on the Use of Wireless Equipment/Systems

F. National Electrical Contractors Association (NECA):

303-2005	Installing Closed Circuit Television (CCTV) Systems

G. National Fire Protection Association (NFPA):

70-2017	Article 780-National Electrical Code

H. Federal Information Processing Standard (FIPS):

140-2-02	Security Requirements for Cryptographic Modules

I. Underwriters Laboratories, Inc. (UL):

983-06	Standard for Surveillance Camera Units
3044-01	Standard for Surveillance Closed Circuit Television Equipment

1.9 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. To connecting raceways, cables, wireways, cable trays, and busways shall 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.

1.10 CCTV S YSTEM PROGRAMMING

A. Coordinate arrangement, IP addresses, CCTV VLANS, connections to the remote building with the system contractor and the COR/IT to support a complete programming of the video surveillance equipment for this project:
   1. Schedule a meeting with the VA COR/Police/IT for the system programming.
   2. Every PoE switch shall be programmed for each camera.
   3. Coordinate connection to the VA IT network with the COR/IT.

4. Established a CCTV VLAN for the camera system.
5. The camera system shall have its own VLAN, coordinate with COR/IT.
6. All NVRs and CCTV equipment shall be programmed per VA requirement.
7. Provide 2 additional days in the first 12 months for any upgrades, moves or adds for the programming of the CCTV system.
8. Provide complete electronic files for the system programming.

1.11 WARRANTY OF CONSTRUCTION

A. Warrant VASS 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 MANUFACTURERS

A. Basis of Design Manufacturer: Avigilon.

B. Substitution Limitations:

a. Single manufacturer will provide, from a single source, a fully integrated surveillance system consisting of network cameras and the following components:
b. Video Management System Analytics.
c. Video Management System Interfaces.
d. Video Surveillance Positioning Equipment.
e. Video Surveillance Sensors.

2.2 DESIGN CRITERIA:

1. Video monitoring system must be tightly integrated using application programming interfaces and software development kits.
2. All systems must be capable of functioning autonomously during a failure of one or more of the related sections.
3. Cameras in this section must be capable of bi-directional communication.
4. Video monitoring system to be interfaced through digital communication protocols including but not limited to ASCII or Hexadecimal Data Transmissions.

B. System Certifications:

1. UL and cULus certification mark for Canada/USA.

C. Safety Standards:

1. UL/CSA/IEC/EN 62368-1

2. IEC 62471.

D. Electromagnetic Emissions Standards:

1. FCC Part 15 Subpart B Class B.
2. ICES-003 Class B.
3. EN 55032 Class B.
4. EN 61000-6-3.
5. EN 61000-3-2.
6. EN 61000-3-3.

E. Electromagnetic Emissions Standards:

1. EN 55035.
2. EN 61000-6-1.
3. EN 50130-4
4. EN 50121-4

F. Environmental Standards

1. IEC/EN 62262 Impact (IK 10) Rating.
2. IEC 60829 IP52 Rating.
3. IEC 60529 IP66, IP67, Type 4X, Weather Rating.
4. IEC 60068-2-27 Shock Testing.
5. IEC 60068-2-6 Vibration Testing.
6. IEC 60068-2-14 Change of Temperature Testing.
7. IEC 60068-2-1 Cold Testing.
8. IEC 60068-2-2 Dry Heat Testing.

2.3 PERFORMANCE REQUIREMENTS

A. Standards:

1. Video Standards: H.264 / MJPEG / HDSM SmartCodec technology.
2. Image Standards: MPEG-4 - ISO/IEC 14496-10 AVC (H.264).
3. Networking Standards:
   a. IEEE 802.3af (Power over Ethernet).
   b. IEEE 802.1X (Authentication).
   c. IPv4 (RFC 791).
   d. IPV6

B. Video Requirements:

1. Provide cameras capable of simultaneously delivering at least two individual video streams, for use when connecting to the Video Management Software for recording and live viewing.

2. Provide cameras with a primary stream capable of supporting the video resolution and aspect ratio and capable of generating the image framerates noted in this section.
3. By generating a secondary stream at fractional resolutions of the primary stream, Video device must support HDSM-High Definition Stream Management and/or Dynamic Bandwidth Management.

C. Encoding Requirements:
1. Support compression and image quality settings from 1 to 20 to configure bandwidth utilized by the camera and desired image response. Provide user configuration of compression quality and image rate per camera.
2. Provide independently configured simultaneous H.264 and Motion JPEG streams (multi-stream).
3. Provide independently configured simultaneous H.265 and Motion JPEG streams(multi-stream)
4. Support Motion JPEG encoding in a selectable range from 1 up to 24 frames per second based on resolution configured.
5. Support H.264 encoding in a selectable range from 1 up to 24 frames per second based on resolution configured.
6. Support H.265 encoding in a selectable range from 1 up to 24 frames per second based on resolution configured
7. Support Variable Bit Rate (VBR) in H.264 with a configurable maximum bit rate threshold.
8. Support Variable Bit Rate (VBR) in H.265 with a configurable maximum bit rate threshold
9. Provide user configuration of compression format, compression quality, maximum bit rate, key frame interval, and image rate per camera.
10. Support motion compensation and motion vector during motion estimation in H.264, able to maintain frame rate, regardless of scene complexity, when bandwidth is capped at 12mbps at 24 FPS.
11. Support G.711 PCM 8kHz audio compression.

D. Provide cameras that allow video and audio signals to be transported over:
1. HTTP (Unicast).
2. HTTPS (Unicast).
3. RTP (Unicast & Multicast).

4. RTP over RTSP (Unicast).
5. RTP over RTSP over HTTP (Unicast).
6. RTP over RTSP over HTTPS (Unicast).

E. Image Control Requirements:

1. User Configurations Supported:
   a. Automatic and manual white balance control.
   b. Automatic and manually defined exposure zones operating in the range 1/7.5 to 1/8000 second.
   c. Flicker control (50 Hz, 60 Hz).
   d. Automatic and manual iris control.
   e. Color saturation and sharpening.
   f. Motion detection sensitivity and threshold.
   g. Digital rotation of the image.
2. Adaptive Video Analytics Specifications:
   a. Configured Behaviors: Unlimited number of configured behaviors per video source supported.
   b. Automatic Analytic set up and tuning of behavior identification:
      1) Upon selection of analytic and Region of Interest (ROI), the device will automatically configure behavior identification.
      2) The device will constantly monitor changes in the scene and perform a tuning of the behavior identification parameters as the scene environment changes.
3. Include detection of the following behaviors:
   a. Object present in ROI.
   b. Object enters ROI.
   c. Object leaves ROI.
   d. Object appeared.
   e. Object disappeared.
   f. Object crosses a line of interest or beam.
   g. Object Movement Direction.
   h. Object loitering.
   i. Multiple objects in ROI over specified dwell time.
   j. Dwell Time.
   k. Number of objects exceeds limit in ROI.
   l. Number of objects below limit in ROI.
   m. Camera tampering.
4. Supported Object types

a. Vehicles: Car, truck, bicycle, motorcycle, bus

b. Person

F. Network Requirements: Provide video cameras that have the following network capabilities:

1. Supports both fixed (static) IP addresses and dynamically assigned IP addresses provided by a Dynamic Host Control Protocol (DHCP) server.
2. Supports user configuration of network parameters including:
   a. Fixed (static) IP address.
   b. Subnet mask.
   c. Gateway.
   d. Control port.
3. Are automatically detected when using a Video Management Application (VMA) or Network Video Recorder (NVR) supporting this feature.
4. Provides support for both IPv4 and IPv6 Networks.

G. Video Motion Detection Functionality Requirements: Provide video cameras capable of detecting motion based on:

1. Motion Detection Mask: Defined areas within the camera’s field of view for the camera to detect motion.
2. Sensitivity: How much each pixel within the masked areas must change before it is considered in motion.
3. Threshold: Percentage of pixels that must detect change.

H. Event Functionality Requirements: Equip cameras with an integrated event functionality, which may be trigged by:

1. Alarm input terminal.
2. Video motion detection.
3. Camera temperature outside operative range.

I. Protocol Support Requirements: Provide video cameras that incorporate support for at least the following:

1. IPv4.
2. Ipv6
3. HTTP.
4. HTTPS.
5. SOAP.
6. DNS.
7. NTP.
8. RSTP.

9. RTCP.
10. RTP.
11. TCP.
12. UDP.
13. IGMP.
14. ICMP.
15. DHCP.
16. Zeroconf.
17. ARP.
18. SNMP v2c.
19. SNMP v3.

J. Streaming Support Requirements: Provide video cameras that incorporate support for at least the following:
1. RTP/UDP.
2. RTP/UDP multicast.
3. RTP/RTSP/TCP.
4. RTP/RTSP/HTTP/TCP.
5. RTP/RTSP/HTTPS/TCP.
6. HTTP.

K. Video Overlay Requirements: Provide video cameras with the following overlay requirements:
1. 64 individually configurable privacy zones to conceal defined areas in image as non-viewable. Masks required to be dynamically adjusted based on current zoom-factor, without capability of operator bypass.
2. Video masked by privacy zones must be obscured prior to streaming.

L. Security Requirements: Provide video cameras with the following security requirements:
1. Support the use of the following:
   a. Password protection.
   b. HTTPS Encryption.
   c. Digest authentication.
   d. WS authentication.
   e. User access Log.
   f. SSL encryption.
   g. FIPS 140-2 L1 Encryption
2. Restrict access to the built-in internet server by usernames and passwords at three different user group levels.

M. Electrical Power: Cameras capable of being powered by the following power sources:
   1. PoE: up to IEEE 802.3af Class 3 PoE Compliant.
   2. DC Power: 12-24 VDC +/- 10%.215Y
   3. Battery Backup: 3V manganese lithium. 215Y

N. Installation and Maintenance Requirements: Provide video cameras with the following installation and maintenance requirements:
   1. Allow firmware updates via network.
   2. Store customer-specific settings in a non-volatile memory which cannot be lost during power cuts or soft reset.
   3. Provide Microsoft Windows based management software, allowing camera configuration, upgrade of firmware, and backup of individual camera configurations.

O. Diagnostics:
   1. Equipped with LEDs, indicating the camera’s functional status, which may be user enabled or disabled.
   2. Monitored by functionality which automatically reinitiates processes or restarts the unit if a malfunction is detected.

P. Connectivity:
   1. 100BASE-TX Fast Ethernet-port with RJ-45 socket, auto negotiation of network speed and transfer mode.
   2. Terminal for receiving line level analog audio from an external microphone.
   3. Terminal for providing line level analog audio for connection to an external speaker.

Q. Operational Range:
   1. Temperature: -30 degrees C to +60 degrees C [-22 F to +122 F].
   2. Relative Humidity: 0–95 percent (non-condensing).

2.4 4 MEGAPIXEL IP CAMERAS

A. Indoor Surface Mount Dome Camera with Self-Learning Video Analytics and 4.4-9.3 mm lens.
   1. Basis of Design Product: 4.0C-H6A-D1-IR (D01): 4.0 MP H6A , by Avigilon.
   2. Performance:
      a. Image Sensor:1/1.8 inch progressive scan CMOS.
      b. Maximum Resolution:
         1) Aspect Ratio: 16:9: 2560 x 1440 Aspect Ratio: 4:3: 2304 x 1728

c. Imaging Rate: Up to 60 fps.

d. Wide Dynamic Range: Up to 136 dB @ 20 fps

e. Resolution Scaling: Down to 768 x 432.

f. Minimum Illumination:

1) Color: 0.08 lux (F1.3).

2) Monochrome: 0.008 lux (F1.3).

2.5 5 MEGAPIXEL IP CAMERAS

A. 5.0 H6SL HD Indoor Surface Mount Dome Camera with Self-learning Video Analytics

1. Basis of Design Product: 5.0C-H6SL-D1-IR, by Avigilon .

2. Performance:

a. Image Sensor: 1/2.8 inch progressive scan CMOS.

b. Imaging Area (H x V): H x V): 5.18 mm x 3.89 mm (0.204 inches x 0.153 inches).Imaging Rate: (50 Hz/60 Hz): 25 fps/30 fps .

c. Dynamic Range: 83 dB (WDR off); 130 dB (WDR on).

d. Minimum Illumination:

1) Color: 0 Lux.

e. Monochrome: 0.008 lux (F1.3).

f. Field of View: 30 degrees to 91 degrees.

1) Horizontal Field of View: 95 degrees to 28 degrees. Vertical Field of View: 69 degrees to 21 degrees

2.6 6 MEGAPIXEL IP CAMERAS

A. 6.0 MP H4HD Indoor Surface Mount Dome Camera with Self Learning Video Analytics and 3.35-7mm lens.

1. Basis of Design Product: 6.0C-H5DH-D01-D1-IR, by Avigilon.

2. Performance:

a. Image Sensor: 1/2.7 inch progressive scan CMOS.

b. Active Pixels Aspect Ratio: 2048 x 1536, per sensor.

c. Imaging Area (H x V): 5.12 mm x 3.84 mm [0.202 inches x 0.151 inches].

d. Imaging Rate:

1) Analytics Mode: (50 Hz/60 Hz): 24 fps/25 fps High Framerate Mode: (50 Hz/60 Hz): 30 fps/25 fps

e. Dynamic Range:

1) WDR Off: Up to 82 dB. WDR On: Up to 120 dB.

f. Minimum Illumination:

1) Color: 0.1 lux.

2) Monochrome: 0.05 lux.

g. IR: 0.0 lux. Angle of View:

1) Horizontal: 43 - 91 degrees.

2) Vertical: 32 – 67 degrees

2.7 12 MEGAPIXEL IP CAMERAS

A. 12.0 MP Fisheye Infrared Camera with 1.6 mm lens.

1. Basis of Design Product: 12.0W-H5A-FE-DO1-IR, by Avigilon.

2. Performance:

a. Image Sensor: 1/2.3 inch progressive scan CMOS

b. Imaging:

c. Warped 360-degree streams with full analytics features in full feature mode

1) Primary Stream Maximum Resolution: 3008 x 3008

2) Secondary Stream Maximum Resolution: 515 x 512

3) Tertiary Stream Maximum Resolution: 320 x 320.

d. Dewarped Video Streams with analytics disabled:

1) Primary Stream:

a) 180 Degrees by 2: 3072 x 1232.

b) 120 Degrees by 3: 2048 x 1232.

c) 90 Degrees by 4: 1536 x 1232.

2) Secondary Stream:

a) 180 Degrees by 2: 768 x 304.

b) 120 Degrees by 3: 512 x 304.

c) 90 Degrees by 4: 384 x 304.

e. Imaging Rate

1) (50 Hz/60 Hz): 25 fps/30 fps. Maximum imaging rate requires High framerate mode

f. Dynamic Range:

1) WDR Off: Up to 83 dB

2) WDR On: Up to 120 dB

g. Minimum Illumination:

1) Color: 0.38 lux

2) Monochrome: 0.19

3) IR: 0.0 lux; maximum distance 12 m (39 ft).

2.8 MEGAPIXEL IP CAMERAS

A. 20MP HD Multisensor Camera; four 5MP sensors, wide dynamic range (WDR), 3.3mm – 5.7mm lens.

1. Basis of Design Product: 20C-H5A-4MH – H5A Multisensor Camera, by Avigilon.
2. Performance:
   a. Image Sensors: 1/2.8 inch progressive scan CMOS.
   b. Field of View
      1) Aspect Ratio: 4:3
         a) Horizontal: 53 degrees to 99 degrees per sensor; up to 360 degrees combined.
         b) Vertical: 39 degrees to 69 degrees per sensor.
      2) Aspect Ratio: 16:9
         a) Horizontal: 53 degrees to 97 degrees per sensor; up to 270 degrees combined.
         b) Vertical: 29 degrees to 50 degrees per sensor.
   c. Active Pixels (H x V): 2592 x 1944 per sensor.
   d. Imaging Rate:
      1) With WDR on: 24 fps at 60Hz and 25 fps at 50Hz.
      2) With WDR off: 30 fps at 60Hz and 25 fps at 50Hz
   e. IR Illumination:
      1) Color Mode: 0.02 lux (F1.5).
      2) Mono Mode 0.018 lux (F1.5).
   f. Dynamic Range: 120 dB with WDR active.

2.9 24 MEGAPIXEL IP CAMERAS

A. A 24MP HD Multisensor Camera; three 8MP sensors, wide dynamic range (WDR), 3.3mm -5.7mm lens:
1. Basis of Design Product: 24C-H5A-3MH – H5A Multi sensor Camera, by Avigilon
2. Performance:
   a. Image Sensors: 1/2.5 inch progressive scan CMOS.
      1) 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.
      2) 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.
   b. Active Pixels (H x V): 3840 x 2160 per sensor.

c. Imaging Rate:
   1) With WDR on: 24 fps at 60Hz and 20 fps at 50Hz.
   2) With WDR off: 24 fps at 60Hz and 25 fps at 50Hz
d. IR Illumination:
   1) Color Mode: 0.02 lux (F1.5).
   2) Mono Mode 0.016 lux (F1.5)
   3) With IR Illuminator: 0 lux
e. Dynamic Range: 120 dB with WDR active.

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 shall 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 VASS System shall 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 VASS 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.

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 VASS System shall have 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 VASS System shall be comprised of 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 shall 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 VASS 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 shall 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. Video Encoder/Decoder

1. Install the Video Encoder/Decoder per design and construction documents, and as specified by the OEM.
2. Connect analog camera inputs to video encoder.
3. Connect network camera to video decoder.
4. Connect video encoder to VASS network.
5. Connect video decoder to video matrix, DVR, and monitor.
6. Connect unit to AC power (UPS).
7. Configure the video encoder/decoder per manufacturer’s recommendation and project requirements.

O. 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 VASS 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)
      i. Reports
P. 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
Q. 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.

3.3 EXAMINATION

A. Verification of Conditions: Do not begin installation until substrates have been properly prepared.

B. Evaluation and Assessment: If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.4 PREPARATION

A. Surface Preparation: Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.5 ADJUSTING

A. Fine Tuning: Perform field software changes after initial programming session to “fine tune” operating parameters and sequence of operations based on any revisions to Owner’s operating requirements.

3.6 CLOSEOUT

A. Demonstration:

1. Demonstrate administration and operation of devices described by this section.
2. Demonstrate how to authorize users and applications to operate and configure installed devices.
3. Demonstrate how an authorized user can gain access to and make changes to configuration.
4. Demonstrate how to operate functionality configured for this project as defined by configuration punch list.

3.7 SYSTEM START-UP

A. Test equipment and configure system in accordance with instructions provided by the manufacturer prior to installation.

B. Configure equipment requiring users to log on using a password with user/site-specific credentials. Default passwords are not acceptable and must be configured prior to project closeout.

C. Provide products with the latest and most up-to-date firmware by the manufacturer or provide firmware of a version specified by the provider of the Video Management Application (VMA) or Network Video Recorder (NVR).

D. The Contractor shall not apply power to the VASS System until the following items have been completed:

1. VASS System equipment items and have been set up in accordance with manufacturer's instructions.
2. A visual inspection of the VASS 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 VASS System have been verified as the correct voltage, phasing, and frequency as indicated.

E. Coordinate the startup and contractor testing schedules with the Contracting Officer’s Representative. Provide a minimum of 7 days prior notice.

F. 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.

3.8 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 VASS System; and are approved by the Contracting Officer.

B. The Contractor shall 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.

3.9 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 for four hours to instruct VA personnel in operation and maintenance of units.

---END---