

**DEPARTMENT OF VETERANS AFFAIRS  
VHA MASTER SPECIFICATIONS**

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**SECTION 00 01 15**  
**LIST OF DRAWING SHEETS**

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

<u>Drawing No.</u>	<u>Title</u>
<b>GENERAL</b>	
G-001	COVER SHEET
G-002	STANDARDS INDEX
G-003	CODE REVIEW
<b>ARCHITECTURAL</b>	
AS-101	BASEMENT-SIGNALS CLOSET DEMOLITION PLANS
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<b>TECHNOLOGY</b>	
ET-001	LEGEND, SYMBOLS AND INDEX OF DRAWINGS
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ET-501	DETAILS

VA CINCINNATI PROJECT NO. 539-17-210  
UPGRADE FIRE RADIO SYSTEM  
52109.00

VA250-15-J-0951

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

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**SECTION 01 00 00  
GENERAL REQUIREMENTS****1.1 GENERAL INTENTION**

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing electrical equipment, and furnish labor and materials and perform work for VA Project 539-17-201 as required by drawings and specifications.
- B. Medical Center Engineering Officer will schedule a pre-bid site walk-through for all contractors wishing to see the site. No other access will be permitted.
- C. Offices of Levin-Porter Associates, as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative.
- D. Before placement and installation of work subject to tests by testing laboratory retained by the Contractor, 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 work days 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.
- G. Training:
  - 1. All employees of general contractor or subcontractors shall have the 10-hour or 30-hour OSHA Construction Safety course and other relevant competency training, as determined by COR acting as the Construction Safety Officer with input from the facility Construction Safety Committee.
  - 2. Submit training records of all such employees for approval before the start of work.
- H. VHA Directive 2011-36, Safety and Health during Construction, dated 9/22/2011 in its entirety is made a part of this section.

- I. VA will evaluate and consider past safety records of prospective contractors in awarding contracts. At a minimum, Contractors must not have more than three serious, or one repeat, or one willful OSHA violation(s) in the past 3 years, or any significant environmental penalties. Additionally, Contractors must have an Experience Modification Rate (EMR) of equal to or less than 1.0 (EMR of 1.0 indicates that a Contractor had an average insurance claim's rate for worker injuries).

## **1.2 STATEMENT OF BID ITEM(S)**

- A. BID ITEM #1: Work shall include all labor, material, equipment and supervision required to complete project 539-17-201 at the Department of Veterans Affairs Medical Center, 3200 Vine Street, Cincinnati, Ohio 45220. Work includes general construction, alterations, technology and electrical work, utility systems, demolition and certain other items shown and specified. All phases of work shall be complete within **185** calendar days after receipt of Notice to Proceed.

## **1.3 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.
  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 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.
  - b. "Sensitive information" including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.



**F. Motor Vehicle Restrictions**

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
2. A limited number of (2 to 5) permits shall be issued for General Contractor and its employees for parking in designated areas only.

**1.4 FIRE SAFETY**

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

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

E84-2009 ..... Surface Burning Characteristics of Building Materials

2. National Fire Protection Association (NFPA):

10-2010..... Standard for Portable Fire Extinguishers

30-2008..... Flammable and Combustible Liquids Code

51B-2009 ..... Standard for Fire Prevention During Welding, Cutting and Other  
Hot Work

70-2014..... National Electrical Code

101-2012..... Life Safety Code

241-2009..... Standard for Safeguarding Construction, Alteration, and  
Demolition Operations

3. Occupational Safety and Health Administration (OSHA):

29 CFR 1926 ..... Safety and Health Regulations for Construction

4. VHA Directive 2005-007

- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to COR and Facility Safety Officer for review for compliance with VHA Directive 2005-007, NFPA 101 and NFPA 241. Prior to beginning work, all employees of the contractor and/or any subcontractors shall undergo a safety briefing provided

by the general contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Provide documentation to the COR that all construction workers have undergone contractor's safety briefing.

- C. 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.
- 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/or the areas that are described in phasing requirements and adjoining areas. Construct partitions of flame-retardant plastic sheeting (flame spread rating of 25 or less in accordance with ASTM E84). Extend the partitions from suspended ceilings to floor slab deck. Seal joints and penetrations.
  - 2. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.
- F. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- G. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with COR and facility Safety Officer.
- H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COR and facility Safety Officer.
- I. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- J. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- K. 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 and facility Safety Officer. 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.

- L. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with COR and facility Safety Officer.
- M. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR. Obtain permits from facility Safety Officer at least 72 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.
- N. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to COR and facility Safety Officer.
- O. Smoking: Smoking is prohibited on the VA campus except in designated smoking rest areas.
- P. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- Q. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.
- R. If required, submit documentation to the COR that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

## **1.5 OPERATIONS AND STORAGE AREAS**

- 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.

**(FAR 52.236-10)**

- D. Working space and space available for storing materials shall be as determined by the COR.
- E. Workmen are subject to rules of Medical Center applicable to their conduct.
- F. Execute work so as to interfere as little as possible with normal functioning of the 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 the COR or 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 and approval by the COR.

- G. Phasing:

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:

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

- H. When a building is turned over to Contractor, Contractor shall accept entire responsibility 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.
- I. 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 the COR's prior knowledge and written approval.
  - 2. Contractor shall submit a request to interrupt any such services to COR, in writing, 48 hours 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 21 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.
- J. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged. 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.
- K. 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.
- L. 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 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 the building.
  2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, shades, etc., required by drawings to be either reused or relocated, or both.

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

**1.7 INFECTION PREVENTION MEASURES**

- A. Implement the requirements of VAMC's Construction Health and Safety Team (CHST). CHST Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.
- B. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by CHST Group as specified here. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to COR and Facility CHST team for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
  - 1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.
- C. Medical center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality. In addition:
  - 1. The COR and VAMC Infection Control personnel shall review pressure differential monitoring documentation to verify that pressure differentials in the construction zone and in the patient-care rooms are appropriate for their settings. The requirement for negative air pressure in the construction zone shall depend on the location and type of activity. Upon notification, the contractor shall implement corrective measures to restore proper pressure differentials as needed.
  - 2. In case of any problem, the medical center, along with assistance from the contractor, shall conduct an environmental assessment to find and eliminate the source.
- D. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold.
  - 1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by COR. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction.



2. Do not perform dust producing tasks within occupied areas without the approval of the COR. For construction in any areas that will remain jointly occupied by the medical Center and Contractor's workers, the Contractor shall:
  - a. Provide a fire retardant polystyrene, 6-mil thick or greater plastic barrier meeting local fire codes.
  - b. Use of negative pressure machines with HEPA filtration is required throughout entire construction process. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. Install HEPA (High Efficiency Particulate Accumulator) filter vacuum system rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. Insure continuous negative air pressures occurring within the work area. HEPA filters should have ASHRAE 85 or other pre-filter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Exhaust hoses shall be heavy duty, flexible steel reinforced and exhausted so that dust is not reintroduced to the medical center.
  - c. Adhesive Walk-off/Carpet Walk-off Mats, minimum 600mm x 900mm (24" x 36"), shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
  - d. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as they are created. Transport these outside the construction area in containers with tightly fitting lids.
  - e. The contractor shall not haul debris through patient-care areas without prior approval of the COR and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
  - f. Using a HEPA vacuum, clean inside the barrier and vacuum ceiling tile prior to replacement. Any ceiling access panels opened for investigation beyond sealed areas shall be sealed immediately when unattended.

- g. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.
  - h. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.
- E. Final Cleanup:
- 1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
  - 2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
  - 3. All new air ducts shall be cleaned prior to final inspection.

## **1.8 DISPOSAL AND RETENTION**

- A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:
- 1. Reserved items which are to remain property of the Government are identified by attached tags as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by the COR.
  - 2. Items not reserved shall become property of the Contractor and be removed by Contractor from the 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.
    - a. Copies of the following listed CFR titles may be obtained from the Government Printing Office:  
  
40 CFR 261 ..... Identification and Listing of Hazardous Waste

40 CFR 262.....	Standards Applicable to Generators of Hazardous Waste
40 CFR 263.....	Standards Applicable to Transporters of Hazardous Waste
40 CFR 761.....	PCB Manufacturing, Processing, Distribution in Commerce, and use Prohibitions
49 CFR 172.....	Hazardous Material tables and Hazardous Material Communications Regulations
49 CFR 173.....	Shippers - General Requirements for Shipments and Packaging
49 CFR 173 .....	Subpart A General
49 CFR 173.....	Subpart B Preparation of Hazardous Material for Transportation
49 CFR 173.....	Subpart J Other Regulated Material; Definitions and Preparation
TSCA.....	Compliance Program Policy Nos. 6-PCB-6 and 6-PCB-7

## 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 workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause

entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

#### **1.10 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 insure compliance, as-built drawings shall be made available for the COR review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings in the electronic version (scanned PDF) to the COR within 15 calendar days after each completed phase and after the acceptance of the project by the COR.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

#### **1.11 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 Nos.5 and 6 in Building Three for daily use and 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 contractor's expense.

**1.12 TEMPORARY TOILETS**

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

**1.13 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 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.
- C. 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.
    - a. Steam is available at no cost to Contractor.
- D. Electricity (for Construction and Testing): Furnish all temporary electric services.
1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.
- E. Water (for Construction and Testing): Furnish temporary water service.
1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection. 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's discretion) of use of water from Medical Center's system.
- F. Steam: Furnish steam system for testing required in various sections of specifications.
1. Obtain steam for testing by connecting to the Medical Center steam distribution system. Steam is available at no cost to the Contractor.
  2. Maintain connections, pipe, fittings and fixtures and conserve steam-use so none is wasted. Failure to stop leakage or other waste will be cause for revocation (at COR's discretion), of use of steam from the Medical Center's system.

#### **1.14 TESTS**

- A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- B. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.
- C. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire complex which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc. Another example of a complex which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feedwater, condensate and other related components.
- D. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably short period of time during which operating and environmental conditions remain reasonably constant.
- E. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

**1.15 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.

**1.16 GOVERNMENT-FURNISHED PROPERTY**

- A. The Government shall deliver to the Contractor, the Government-furnished property shown on the schedule and drawings.
- B. Equipment furnished by Government to be installed by Contractor will be furnished to Contractor at the Medical Center.
- C. Storage space for equipment will be provided by the Government and the Contractor shall be prepared to unload and store such equipment therein upon its receipt at the Medical Center.
- D. Notify Contracting Officer in writing, 60 days in advance, of date on which Contractor will be prepared to receive equipment furnished by Government. Arrangements will then be made by the Government for delivery of equipment.
  - 1. Immediately upon delivery of equipment, Contractor shall arrange for a joint inspection thereof with a representative of the Government. At such time the Contractor shall acknowledge receipt of equipment described, make notations, and immediately furnish the Government representative with a written statement as to its condition or shortages.
  - 2. Contractor thereafter is responsible for such equipment until such time as acceptance of contract work is made by the Government.
- E. Equipment furnished by the Government will be delivered in a partially assembled (knock down) condition in accordance with existing standard commercial practices, complete with all fittings, fastenings, and appliances necessary for connections to respective services installed under contract. All fittings and appliances (i.e., couplings, elbows, tees, nipples, piping, conduits, cables, and the like) necessary to make the connection between the Government furnished equipment item and the utility stub-up shall be furnished and installed by the contractor at no additional cost to the Government.
- F. Completely assemble and install the Government furnished equipment in place ready for proper operation in accordance with specifications and drawings.
- G. Furnish supervision of installation of equipment at construction site by qualified factory trained technicians regularly employed by the equipment manufacturer.

**1.17 PHOTOGRAPHIC DOCUMENTATION**

- A. During the construction period through completion, provide photographic documentation of construction progress on a daily basis. Pictures taken with cellular phone and emailed to the COR is acceptable.



VA250-15-J-0951

VA CINCINNATI PROJECT NO. 539-17-210  
UPGRADE FIRE RADIO SYSTEM

--- E N D ---

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

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, samples test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Submit for review, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
  - A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
  - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
  - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
- 1-5. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by COR on behalf of the Contracting Officer.
- 1-6. Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.
- 1-7. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.
- 1-8. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and

Architect- Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.

- 1-9. Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.
  - A. Submit samples in quadruplicate. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.
  - B. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail and shall contain the list of items, name of Medical Center, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
    1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
    2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
    3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
  - C. In addition to complying with the applicable requirements specified in preceding Article 1.9, samples which are required to have Laboratory Tests (those preceded by symbol "LT" under the separate sections of the specification shall be tested, at the expense of Contractor, in a commercial laboratory approved by Contracting Officer.
    1. Laboratory shall furnish Contracting Officer with a certificate stating that it is fully equipped and qualified to perform intended work, is fully acquainted with specification requirements and intended use of materials and is an independent establishment in no way connected with organization of Contractor or with manufacturer or supplier of materials to be tested.
    2. Certificates shall also set forth a list of comparable projects upon which laboratory has performed similar functions during past five years.
    3. Samples and laboratory tests shall be sent directly to an approved commercial testing laboratory.
    4. Contractor shall forward a copy of transmittal letter to COR simultaneously with submission to a commercial testing laboratory.
    5. Laboratory test reports shall be sent directly to COR for appropriate action.

6. Laboratory reports shall list contract specification test requirements and a comparative list of the laboratory test results. When tests show that the material meets specification requirements, the laboratory shall so certify on test report.
  7. Laboratory test reports shall also include a recommendation for approval or disapproval of tested item.
- D. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.
- E. Approved samples will be kept on file by the COR at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.
- F. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.
1. For each drawing required, submit one legible photographic paper or vellum reproducible.
  2. Reproducible shall be full size.
  3. Each drawing shall have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
  4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
  5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
  6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
  7. When work is directly related and involves more than one trade, shop drawings shall be submitted to Architect-Engineer under one cover.
- 1-10. Samples, shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for review to the COR for forwarding to the Architect-Engineer.

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

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

**1.1 APPLICABLE PUBLICATIONS:**

- A. Latest publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.
- B. American Society of Safety Engineers (ASSE):
  - A10.1-2011 .....Pre-Project & Pre-Task Safety and Health Planning
  - A10.34-2012 .....Protection of the Public on or Adjacent to Construction Sites
  - A10.38-2013 .....Basic Elements of an Employer's Program to Provide a Safe and Healthful Work Environment American National Standard Construction and Demolition Operations
- C. American Society for Testing and Materials (ASTM):
  - E84-2013 .....Surface Burning Characteristics of Building Materials
- D. The Facilities Guidelines Institute (FGI):
  - FGI Guidelines-2010Guidelines for Design and Construction of Healthcare Facilities
- E. National Fire Protection Association (NFPA):
  - 10-2013.....Standard for Portable Fire Extinguishers
  - 30-2012.....Flammable and Combustible Liquids Code
  - 51B-2014 .....Standard for Fire Prevention During Welding, Cutting and Other Hot Work
  - 70-2014.....National Electrical Code
  - 70B-2013 .....Recommended Practice for Electrical Equipment Maintenance
  - 70E-2012 .....Standard for Electrical Safety in the Workplace
  - 99-2012.....Health Care Facilities Code
  - 241-2013.....Standard for Safeguarding Construction, Alteration, and Demolition Operations
- F. The Joint Commission (TJC)

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

G. U.S. Nuclear Regulatory Commission

10 CFR 20 ..... Standards for Protection against Radiation

H. U.S. Occupational Safety and Health Administration (OSHA):

29 CFR 1904 ..... Reporting and Recording Injuries & Illnesses

29 CFR 1910 ..... Safety and Health Regulations for General Industry

29 CFR 1926 ..... Safety and Health Regulations for Construction Industry

CPL 2-0.124..... Multi-Employer Citation Policy

I. VHA Directive 2005-007

**1.2 DEFINITIONS:**

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

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

### **1.3 REGULATORY REQUIREMENTS:**

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

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

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



- 1) Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience);
  - 2) Plan approver (company/corporate officers authorized to obligate the company);
  - 3) Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).
- b. **BACKGROUND INFORMATION.** List the following:
- 1) Contractor;
  - 2) Contract number;
  - 3) Project name;
  - 4) Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).
- c. **STATEMENT OF SAFETY AND HEALTH POLICY.** Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor's written safety program goals, objectives, and accident experience goals for this contract should be provided.
- d. **RESPONSIBILITIES AND LINES OF AUTHORITIES.** Provide the following:
- 1) A statement of the employer's ultimate responsibility for the implementation of his SOH program;
  - 2) Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.
  - 3) The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA Competent/Qualified Person(s) requirements must be attached.
  - 4) Requirements that no work shall be performed unless a designated competent person is present on the job site;
  - 5) Requirements for pre-task Activity Hazard Analysis (AHAs);

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

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

- 1) Identification of subcontractors and suppliers (if known);
- 2) Safety responsibilities of subcontractors and suppliers.

**f. TRAINING.**

- 1) Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.
- 2) Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space, etc....) and any requirements for periodic retraining/recertification are required.
- 3) Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.
- 4) OSHA 10-hour training is required for all workers on site and the OSHA 30-hour training is required for Trade Competent Persons (CPs)

**g. SAFETY AND HEALTH INSPECTIONS.**

- 1) Specific assignment of responsibilities for a minimum daily job site safety and health inspection during periods of work activity: Who will conduct (e.g., "Site Safety and Health CP"), proof of inspector's training/qualifications, when inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures.
- 2) Any external inspections/certifications that may be required (e.g., contracted CSP or CSHT)

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

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

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

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

- 20) Health hazard control program;
  - 21) Radiation Safety Program;
  - 22) Abrasive blasting;
  - 23) Heat/Cold Stress Monitoring;
  - 24) Crystalline Silica Monitoring (Assessment);
  - 25) Demolition plan (to include engineering survey);
  - 26) Formwork and shoring erection and removal;
  - 27) Pre-Cast Concrete.
- C. Submit the APP to the COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 [Fifteen] calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.
- D. Once accepted by the COR, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.
- E. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the COR. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ASSE/SAFE A10.34) and the environment.

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

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

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

developed by the contractor, supplier, or subcontractor and provided to the prime contractor for review and approval and then submitted to the COR

**1.6 PRECONSTRUCTION CONFERENCE:**

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

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

- A. The Prime Contractor shall designate a minimum of one SSHO at each project site that will be identified as the SSHO to administer the Contractor's safety program and government-accepted Accident Prevention Plan. Each subcontractor shall designate a minimum of one CP in compliance with 29 CFR 1926.20 (b) (2) that will be identified as a CP to administer their individual safety programs.
- B. Further, all specialized Competent Persons for the work crews will be supplied by the respective contractor as required by 29 CFR 1926 (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).
- C. These Competent Persons can have collateral duties as the subcontractor's superintendent and/or work crew lead persons as well as fill more than one specialized CP role (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).
- D. The SSHO or an equally-qualified Designated Representative/alternate will maintain a presence on the site during construction operations in accordance with FAR Clause 52.236-6: *Superintendence by the Contractor*. CPs will maintain presence during their construction

activities in accordance with above mentioned clause. A listing of the designated SSHO and all known CPs shall be submitted prior to the start of work as part of the APP with the training documentation and/or AHA as listed in Section 1.8 below.

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

#### **1.8 TRAINING:**

- A. The designated Prime Contractor SSHO must meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the requirements of 29 CFR 1926.16 and other appropriate Federal, State and local requirements are met for the project. As a minimum the SSHO must have completed the OSHA 30-hour Construction Safety class and have five (5) years of construction industry safety experience or three (3) years if he/she possesses a Certified Safety Professional (CSP) or certified Construction Safety and Health Technician (CSHT) certification or have a safety and health degree from an accredited university or college.
- B. All designated CPs shall have completed the OSHA 30-hour Construction Safety course within the past 5 years.
- C. In addition to the OSHA 30 Hour Construction Safety Course, all CPs with high hazard work operations such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations shall have a specialized formal course in the hazard recognition & control associated with those high hazard work operations. Documented "repeat" deficiencies in the execution of safety requirements will require retaking the requisite formal course.
- D. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course and any necessary safety training to be able to identify hazards within their work environment.
- E. Submit training records associated with the above training requirements to the COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 [Fifteen] calendar days prior to the date of the preconstruction conference for acceptance.
- F. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the SSHO or his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC

equipment, emergency procedures, accident reporting etc... Documentation shall be provided to the COR that individuals have undergone contractor's safety briefing.

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

#### **1.9 INSPECTIONS:**

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

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

- A. Notify the COR as soon as practical, but no more than four hours after any accident meeting the definition of OSHA Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than \$5,000, or any weight handling equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the COR determine whether a government investigation will be conducted.



- B. Conduct an accident investigation for recordable injuries and illnesses, for Medical Treatment defined in paragraph DEFINITIONS, and property damage accidents resulting in at least \$20,000 in damages, to establish the root cause(s) of the accident. Complete the VA Form 2162, and provide the report to the COR 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 monthly.
- D. A summation of all OSHA recordable accidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the COR as requested.

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

- A. PPE is governed in all areas by the nature of the work the employee is performing. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.
- B. Mandatory PPE includes:
  - 1. Hard Hats – unless written authorization is given by the COR in circumstances of work operations that have limited potential for falling object hazards such as during finishing work or minor remodeling. With authorization to relax the requirement of hard hats, if a worker becomes exposed to an overhead falling object hazard, then hard hats would be required in accordance with the OSHA regulations.
  - 2. Safety glasses - unless written authorization is given by the COR appropriate safety glasses meeting the ANSI Z.87.1 standard must be worn by each person on site.
  - 3. Appropriate Safety Shoes – based on the hazards present, safety shoes meeting the requirements of ASTM F2413-11 shall be worn by each person on site unless written authorization is given by the COR .
  - 4. Hearing protection - Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.

#### **1.12 INFECTION CONTROL**

- A. Infection Control is critical in all medical center facilities. Interior construction activities causing disturbance of existing dust, or creating new dust, must be conducted within ventilation-controlled areas that minimize the flow of airborne particles into patient areas. Exterior construction activities causing disturbance of soil or creates dust in some other manner must be controlled.

B. An AHA associated with infection control will be performed by VA personnel in accordance with FGI Guidelines (i.e. Infection Control Risk Assessment (ICRA)). The ICRA procedure found on the American Society for Healthcare Engineering (ASHE) website will be utilized. Risk classifications of Class II or lower will require approval by the COR or Government Designated Authority before beginning any construction work. Risk classifications of Class III or higher will require a permit before beginning any construction work. Infection Control permits will be issued by the COR. The Infection Control Permits will be posted outside the appropriate construction area. More than one permit may be issued for a construction project if the work is located in separate areas requiring separate classes. The primary project scope area for this project is: **Class 2**. Work in or adjacent to the Operating Suite will be **Class 3** however, work outside the primary project scope area may vary. The required infection control precautions with each class are as follows:

1. **Class I requirements:**

a. During Construction Work:

- 1) Notify the COR or Government Designated Authority
- 2) Execute work by methods to minimize raising dust from construction operations.
- 3) Ceiling tiles: Immediately replace a ceiling tiles displaced for visual inspection.

b. Upon Completion:

- 1) Clean work area upon completion of task
  - 2) Notify the COR or Government Designated Authority of completion.
2. **Class II requirements:**

c. During Construction Work:

- 1) Notify the COR or Government Designated Authority
- 2) Provide active means to prevent airborne dust from dispersing into atmosphere such as wet methods or tool mounted dust collectors where possible.
- 3) Water mist work surfaces to control dust while cutting.
- 4) Seal unused doors with duct tape.
- 5) Block off and seal air vents.
- 6) Remove or isolate HVAC system in areas where work is being performed.

- d. Upon Completion:
  - 1) Wipe work surfaces with cleaner/disinfectant.
  - 2) Contain construction waste before transport in tightly covered containers.
  - 3) Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area.
  - 4) Upon completion, restore HVAC system where work was performed
  - 5) Notify the COR or Government Designated Authority.
- 2. **Class II requirements:**
  - a. During Construction Work:
    - 1) Notify the COR or Government Designated Authority
    - 2) Provide active means to prevent airborne dust from dispersing into atmosphere such as wet methods or tool mounted dust collectors where possible.
    - 3) Water mist work surfaces to control dust while cutting.
    - 4) Seal unused doors with duct tape.
    - 5) Block off and seal air vents.
    - 6) Remove or isolate HVAC system in areas where work is being performed.
  - b. Upon Completion:
    - 1) Wipe work surfaces with cleaner/disinfectant.
    - 2) Contain construction waste before transport in tightly covered containers.
    - 3) Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area.
    - 4) Upon completion, restore HVAC system where work was performed
    - 5) Notify the COR or Government Designated Authority
- 3. **Class III requirements:**
  - a. During Construction Work:
    - 1) Obtain permit from the COR or Government Designated Authority.

- 2) Remove or Isolate HVAC system in area where work is being done to prevent contamination of duct system.
  - 3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
  - 4) Maintain negative air pressure, 0.01 inches of water gauge, within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording and alarm instrument, which must be calibrated on installation, maintained with periodic calibration and monitored by the contractor.
  - 5) Contain construction waste before transport in tightly covered containers.
  - 6) Cover transport receptacles or carts. Tape covering unless solid lid.
- b. Upon Completion:
- 1) Do not remove barriers from work area until completed project is inspected by the COR or Government Designated Authority and thoroughly cleaned by the VA Environmental Services Department.
  - 2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
  - 3) Vacuum work area with HEPA filtered vacuums.
  - 4) Wet mop area with cleaner/disinfectant.
  - 5) Upon completion, restore HVAC system where work was performed.
  - 6) Return permit to the COR or Government Designated Authority.
- B. Upon Completion:
- 1) Do not remove barriers from work area until completed project is inspected by the COR or Government Designated Authority with thorough cleaning by the VA Environmental Services Dept.
  - 2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.

- 3) Contain construction waste before transport in tightly covered containers.
  - 4) Cover transport receptacles or carts. Tape covering unless solid lid.
  - 5) Vacuum work area with HEPA filtered vacuums.
  - 6) Wet mop area with cleaner/disinfectant.
  - 7) Upon completion, restore HVAC system where work was performed.
  - 8) Return permit to the COR or Government Designated Authority.
- C. Barriers shall be erected as required based upon classification (Class III & IV requires barriers) and shall be constructed as follows:
1. Class III and IV - closed door with masking tape applied over the frame and door is acceptable for projects that can be contained in a single room.
  2. Construction, demolition or reconstruction not capable of containment within a single room must have the following barriers erected and made presentable on hospital occupied side:
    - a. Class III & IV (where dust control is the only hazard, and an agreement is reached with the COR and Medical Center) - Airtight plastic barrier that extends from the floor to ceiling. Seams must be sealed with duct tape to prevent dust and debris from escaping
    - b. Class III & IV - Drywall barrier erected with joints covered or sealed to prevent dust and debris from escaping.
    - c. Class III & IV - Seal all penetrations in existing barrier airtight
    - d. Class III & IV - Barriers at penetration of ceiling envelopes, chases and ceiling spaces to stop movement air and debris
    - e. Class IV only - Anteroom or double entrance openings that allow workers to remove protective clothing or vacuum off existing clothing
    - f. Class III & IV - At elevators shafts or stairways within the field of construction, overlapping flap minimum of two feet wide of polyethylene enclosures for personnel access.
- D. Products and Materials:
1. Sheet Plastic: Fire retardant polystyrene, 6-mil thickness meeting local fire codes
  2. Barrier Doors: Self closing solid core wood in steel frame, painted

3. Dust proof 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 pre-filter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer's instructions.
  5. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose
  6. Adhesive Walk-off Mats: Provide minimum size mats of 24 inches x 36 inches
  7. Disinfectant: Hospital-approved disinfectant or equivalent product
  8. Portable Ceiling Access Module
- E. Before any construction on site begins, all contractor personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.
- F. A dust control program will be establish and maintained as part of the contractor's infection preventive measures in accordance with the FGI Guidelines for Design and Construction of Healthcare Facilities. Prior to start of work, prepare a plan detailing project-specific dust protection measures with associated product data, including periodic status reports, and submit to COR and Facility CSC for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- G. Medical center Infection Control personnel will monitor for airborne disease (e.g. aspergillosis) during construction. A baseline of conditions will be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality with safe thresholds established.
- H. In general, the following preventive measures shall be adopted during construction to keep down dust and prevent mold.
1. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. HEPA filtration is required where the exhaust dust may reenter the medical center.
  2. Exhaust hoses shall be exhausted so that dust is not reintroduced to the medical center.

3. Adhesive Walk-off/Carpet Walk-off Mats shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
  4. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as it is created. Transport these outside the construction area in containers with tightly fitting lids.
  5. The contractor shall not haul debris through patient-care areas without prior approval of the COR and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
  6. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.
  7. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.
- I. Final Cleanup:
1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
  2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
  3. All new air ducts shall be cleaned prior to final inspection.
- J. Exterior Construction
1. 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.
  2. Dust created from disturbance of soil such as from vehicle movement will be wetted with use of a water truck as necessary

3. 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.

### **1.13 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 or Government Designated Authority for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. This plan may be an element of the Accident Prevention Plan.
- B. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- C. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- D. Temporary Construction Partitions:
  1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas and adjoining areas. Construct partitions of gypsum board or treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on both sides of fire retardant treated wood or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.
  2. Install 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.
- E. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- F. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with COR or Government Designated Authority.



- G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COR.
- H. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- I. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- L. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with COR. All existing fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the COR.
- M. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with COR.
- N. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR at least 48 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.
- O. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to the COR.
- P. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- Q. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- R. If required, submit documentation to the COR or other Government Designated Authority that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

#### **1.14 ELECTRICAL**

- A. All electrical work shall comply with NFPA 70 (NEC), NFPA 70B, NFPA 70E, 29 CFR Part 1910 Subpart J – General Environmental Controls, 29 CFR Part 1910 Subpart S – Electrical, and 29 CFR 1926 Subpart K in addition to other references required by contract.
- B. All qualified persons performing electrical work under this contract shall be licensed journeyman or master electricians. All apprentice electricians performing under this contract shall be deemed unqualified persons unless they are working under the immediate supervision of a licensed electrician or master electrician.
- C. All electrical work will be accomplished de-energized and in the Electrically Safe Work Condition (refer to NFPA 70E for Work Involving Electrical Hazards, including Exemptions to Work Permit). Any Contractor, subcontractor or temporary worker who fails to fully comply with this requirement is subject to immediate termination in accordance with FAR clause 52.236-5(c). Only in rare circumstance where achieving an electrically safe work condition prior to beginning work would increase or cause additional hazards, or is infeasible due to equipment design or operational limitations is energized work permitted. The COR or Government Designated Authority with approval of the Medical Center Director will make the determination if the circumstances would meet the exception outlined above. An AHA specific to energized work activities will be developed, reviewed, and accepted prior to the start of that work.
  - 1. Development of a Hazardous Electrical Energy Control Procedure is required prior to de-energization. A single Simple Lockout/Tagout Procedure for multiple work operations can only be used for work involving qualified person(s) de-energizing one set of conductors or circuit part source. Task specific Complex Lockout/Tagout Procedures are required at all other times.
  - 2. Verification of the absence of voltage after de-energization and lockout/tagout is considered “energized electrical work” (live work) under NFPA 70E, and shall only be performed by qualified persons wearing appropriate shock protective (voltage rated) gloves and arc rate personal protective clothing and equipment, using Underwriters Laboratories (UL) tested and appropriately rated contact electrical testing instruments or equipment appropriate for the environment in which they will be used.
  - 3. Personal Protective Equipment (PPE) and electrical testing instruments will be readily available for inspection by the COR or Government Designated Authority.
- 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 has been accepted by the COR and Facility Safety or Government Designated Authority and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

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

### **1.15 FALL PROTECTION**

- A. The fall protection (FP) threshold height requirement is 6 ft. (1.8 m) for ALL WORK, unless specified differently or the OSHA 29 CFR 1926 requirements are more stringent, to include steel erection activities, systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work.
  - 1. The use of a Safety Monitoring System (SMS) as a fall protection method is prohibited.
  - 2. The use of Controlled Access Zone (CAZ) as a fall protection method is prohibited.
  - 3. A Warning Line System (WLS) may ONLY be used on floors or flat or low-sloped roofs (between 0 - 18.4 degrees or 4:12 slope) and shall be erected around all sides of the work area (See 29 CFR 1926.502(f) for construction of WLS requirements). Working within the WLS does not require FP. No worker shall be allowed in the area between the roof or floor edge and the WLS without FP. FP is required when working outside the WLS.
  - 4. Fall protection while using a ladder will be governed by the OSHA requirements.

### **1.16 SCAFFOLDS AND OTHER WORK PLATFORMS**

- A. All scaffolds and other work platforms construction activities shall comply with 29 CFR 1926 Subpart L.
- B. The fall protection (FP) threshold height requirement is 6 ft. (1.8 m) as stated in Section 1.16.
- C. The following hierarchy and prohibitions shall be followed in selecting appropriate work platforms.
  - 1. Scaffolds, platforms, or temporary floors shall be provided for all work except that can be performed safely from the ground or similar footing.
  - 2. Ladders less than 20 feet may be used as work platforms only when use of small hand tools or handling of light material is involved.

3. Ladder jacks, lean-to, and prop-scaffolds are prohibited.
  4. Emergency descent devices shall not be used as working platforms.
- D. Contractors shall use a scaffold tagging system in which all scaffolds are tagged by the Competent Person. Tags shall be color-coded: green indicates the scaffold has been inspected and is safe to use; red indicates the scaffold is unsafe to use. Tags shall be readily visible, made of materials that will withstand the environment in which they are used, be legible and shall include:
1. The Competent Person's name and signature;
  2. Dates of initial and last inspections.
- E. Mast Climbing work platforms: When access ladders, including masts designed as ladders, exceed 20 ft. (6 m) in height, positive fall protection shall be used.

#### **1.17 CONFINED SPACE ENTRY**

- A. All confined space entry shall comply with 29 CFR 1910.146 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 and/or other Government Designated Authority.

#### **1.18 WELDING AND CUTTING**

As specified in section 1.14, Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with COR and/or other Government Designated Authority. Obtain permits from COR and/or other Government Designated Authority at least 48 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

#### **1.19 LADDERS**

- A. All Ladder use shall comply with 29 CFR 1926 Subpart X.
- B. All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.
- C. Manufacturer safety labels shall be in place on ladders
- D. Step Ladders shall not be used in the closed position
- E. Top steps or cap of step ladders shall not be used as a step

- F. Portable ladders, used as temporary access, shall extend at least 3 ft. (0.9 m) above the upper landing surface.
  - 1. When a 3 ft. (0.9-m) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist workers in mounting and dismounting the ladder.
  - 2. In no case shall the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.
- G. Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or damaged ladders shall be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design.

## **1.20 FLOOR & WALL OPENINGS**

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

4. Non-load-bearing skylights shall be guarded by a load-bearing skylight screen, cover, or railing system along all exposed sides.
5. Workers are prohibited from standing/walking on skylights.

--- 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.

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

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

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

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

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

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

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

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



AIA American Institute of Architects

<http://www.aia.org>

AISC American Institute of Steel Construction

<http://www.aisc.org>

ISI American Iron and Steel Institute

<http://www.steel.org>

AITC American Institute of Timber Construction

<http://www.aitc-glulam.org>

AMCA Air Movement and Control Association, Inc.

<http://www.amca.org>

ANLA American Nursery & Landscape Association

<http://www.anla.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>

ASAE American Society of Agricultural Engineers

<http://www.asae.org>

ASCE American Society of Civil Engineers

<http://www.asce.org>

ASHRAE American Society of Heating, Refrigerating, and  
Air-Conditioning Engineers

<http://www.ashrae.org>

ASME American Society of Mechanical Engineers

<http://www.asme.org>

ASSE American Society of Sanitary Engineering

<http://www.asse-plumbing.org>

ASTM	American Society for Testing and Materials <a href="http://www.astm.org">http://www.astm.org</a>
AWI	Architectural Woodwork Institute <a href="http://www.awinet.org">http://www.awinet.org</a>
AWS	American Welding Society <a href="http://www.aws.org">http://www.aws.org</a>
AWWA	American Water Works Association <a href="http://www.awwa.org">http://www.awwa.org</a>
BHMA	Builders Hardware Manufacturers Association <a href="http://www.buildershardware.com">http://www.buildershardware.com</a>
BIA	Brick Institute of America <a href="http://www.bia.org">http://www.bia.org</a>
CAGI	Compressed Air and Gas Institute <a href="http://www.cagi.org">http://www.cagi.org</a>
CGA	Compressed Gas Association, Inc. <a href="http://www.cganet.com">http://www.cganet.com</a>
CI	The Chlorine Institute, Inc. <a href="http://www.chlorineinstitute.org">http://www.chlorineinstitute.org</a>
CISCA	Ceilings and Interior Systems Construction Association <a href="http://www.cisca.org">http://www.cisca.org</a>
CISPI	Cast Iron Soil Pipe Institute <a href="http://www.cispi.org">http://www.cispi.org</a>
CLFMI	Chain Link Fence Manufacturers Institute <a href="http://www.chainlinkinfo.org">http://www.chainlinkinfo.org</a>
CPMB	Concrete Plant Manufacturers Bureau <a href="http://www.cpmc.org">http://www.cpmc.org</a>
CRA	California Redwood Association <a href="http://www.calredwood.org">http://www.calredwood.org</a>
CRSI	Concrete Reinforcing Steel Institute <a href="http://www.crsi.org">http://www.crsi.org</a>

CTI Cooling Technology Institute

<http://www.cti.org>

DHIDoor and Hardware Institute

<http://www.dhi.org>

EGSA Electrical Generating Systems Association

<http://www.egsa.org>

EEI Edison Electric Institute

<http://www.eei.org>

EPA Environmental Protection Agency

<http://www.epa.gov>

ETL ETL Testing Laboratories, Inc.

<http://www.et1.com>

FAA Federal Aviation Administration

<http://www.faa.gov>

FCC Federal Communications Commission

<http://www.fcc.gov>

FPS The Forest Products Society

<http://www.forestprod.org>

GANAGlass Association of North America

<http://www.cssinfo.com/info/gana.html/>

FM Factory Mutual Insurance

<http://www.fmglobal.com>

GA Gypsum Association

<http://www.gypsum.org>

GSA General Services Administration

<http://www.gsa.gov>

HI Hydraulic Institute

<http://www.pumps.org>

HPVA Hardwood Plywood & Veneer Association

<http://www.hpva.org>

ICBO	International Conference of Building Officials <a href="http://www.icbo.org">http://www.icbo.org</a>
ICEA	Insulated Cable Engineers Association Inc. <a href="http://www.icea.net">http://www.icea.net</a>
ICAC	Institute of Clean Air Companies <a href="http://www.icac.com">http://www.icac.com</a>
IEEE	Institute of Electrical and Electronics Engineers <a href="http://www.ieee.org">http://www.ieee.org</a>
IMSA	International Municipal Signal Association <a href="http://www.imsasafety.org">http://www.imsasafety.org</a>
IPCEA	Insulated Power Cable Engineers Association
NBMA	Metal Buildings Manufacturers Association <a href="http://www.mbma.com">http://www.mbma.com</a>
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry Inc. <a href="http://www.mss-hq.com">http://www.mss-hq.com</a>
NAAMM	National Association of Architectural Metal Manufacturers <a href="http://www.naamm.org">http://www.naamm.org</a>
NAPHCC	Plumbing-Heating-Cooling Contractors Association <a href="http://www.phccweb.org.org">http://www.phccweb.org.org</a>
NBS	National Bureau of Standards See - NIST
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors <a href="http://www.nationboard.org">http://www.nationboard.org</a>
NEC	National Electric Code See - NFPA National Fire Protection Association
NEMA	National Electrical Manufacturers Association <a href="http://www.nema.org">http://www.nema.org</a>
NFPA	National Fire Protection Association <a href="http://www.nfpa.org">http://www.nfpa.org</a>

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

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

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

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

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

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

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

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

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

PCI Precast Pre-stressed Concrete Institute  
<http://www.pci.org>

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

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

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

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

RIS Redwood Inspection Service  
See - CRA

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

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

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

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

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

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

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

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

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

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

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

TPI Truss Plate Institute, Inc.  
583 D'Onofrio Drive; Suite 200

Madison, WI 53719  
(608) 833-5900

UBC      The Uniform Building Code  
          See ICBO

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

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

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

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

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

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**SECTION 01 45 29**  
**TESTING LABORATORY SERVICES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

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

**1.2 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
  - T27-11 ..... Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
  - T96-02 (R2006) ..... Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
  - T99-10 ..... Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop
  - T104-99 (R2007) ..... Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
  - T180-10 ..... Standard Method of Test for Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
  - T191-02(R2006) ..... Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method
- C. American Concrete Institute (ACI):
  - 506.4R-94 (R2004) ..... Guide for the Evaluation of Shotcrete
- D. American Society for Testing and Materials (ASTM):
  - A325-10 ..... Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
  - A370-12 ..... Standard Test Methods and Definitions for Mechanical Testing of Steel Products
  - A416/A416M-10 ..... Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
  - A490-12 ..... Standard Specification for Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
  - C31/C31M-10 ..... Standard Practice for Making and Curing Concrete Test Specimens in the Field



C33/C33M-11a.....	Standard Specification for Concrete Aggregates
C39/C39M-12.....	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
C109/C109M-11b.....	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
C136-06 .....	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
C138/C138M-10b.....	Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
C140-12 .....	Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
C143/C143M-10a.....	Standard Test Method for Slump of Hydraulic Cement Concrete
C172/C172M-10.....	Standard Practice for Sampling Freshly Mixed Concrete
C173/C173M-10b.....	Standard Test Method for Air Content of freshly Mixed Concrete by the Volumetric Method
C330/C330M-09.....	Standard Specification for Lightweight Aggregates for Structural Concrete
C567/C567M-11.....	Standard Test Method for Density Structural Lightweight Concrete
C780-11 .....	Standard Test Method for Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C1019-11 .....	Standard Test Method for Sampling and Testing Grout
C1064/C1064M-11.....	Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete
C1077-11c.....	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
C1314-11a .....	Standard Test Method for Compressive Strength of Masonry Prisms
D422-63(2007) .....	Standard Test Method for Particle-Size Analysis of Soils
D698-07e1 .....	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
D1140-00(2006) .....	Standard Test Methods for Amount of Material in Soils Finer than No. 200 Sieve
D1143/D1143M-07e1.....	Standard Test Methods for Deep Foundations Under Static Axial Compressive Load

- D1188-07e1 ..... Standard Test Method for Bulk Specific Gravity and Density of  
 Compacted Bituminous Mixtures Using Coated Samples
- D1556-07 ..... Standard Test Method for Density and Unit Weight of Soil in  
 Place by the Sand-Cone Method
- D1557-09 ..... Standard Test Methods for Laboratory Compaction  
 Characteristics of Soil Using Modified Effort (56,000ft lbf/ft3  
 (2,700 KNm/m3))
- D2166-06 ..... Standard Test Method for Unconfined Compressive Strength of  
 Cohesive Soil
- D2167-08) ..... Standard Test Method for Density and Unit Weight of Soil in  
 Place by the Rubber Balloon Method
- D2216-10 ..... Standard Test Methods for Laboratory Determination of Water  
 (Moisture) Content of Soil and Rock by Mass
- D2974-07a ..... Standard Test Methods for Moisture, Ash, and Organic Matter of  
 Peat and Other Organic Soils
- D3666-11 ..... Standard Specification for Minimum Requirements for Agencies  
 Testing and Inspecting Road and Paving Materials
- D3740-11 ..... Standard Practice for Minimum Requirements for Agencies  
 Engaged in Testing and/or Inspection of Soil and Rock as used  
 in Engineering Design and Construction
- D6938-10 ..... Standard Test Method for In-Place Density and Water Content of  
 Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- E94-04(2010) ..... Standard Guide for Radiographic Examination
- E164-08..... Standard Practice for Contact Ultrasonic Testing of Weldments
- E329-11c..... Standard Specification for Agencies Engaged in Construction  
 Inspection, Testing, or Special Inspection
- E543-09..... Standard Specification for Agencies Performing Non-Destructive  
 Testing
- E605-93(R2011)..... Standard Test Methods for Thickness and Density of Sprayed  
 Fire Resistive Material (SFRM) Applied to Structural Members
- E709-08..... Standard Guide for Magnetic Particle Examination
- E1155-96(R2008)..... Determining FF Floor Flatness and FL Floor Levelness Numbers
- E. American Welding Society (AWS):  
 D1.D1.1M-10..... Structural Welding Code-Steel

### 1.3 REQUIREMENTS:

- A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a  
 laboratory accreditation authority and will be required to submit a copy of the Certificate of

Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E329, C1077, D3666, D3740, A880, E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."

- B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by COR. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of COR to such failure.
- C. Written Reports: Testing laboratory shall submit test reports to COR, Contractor, unless other arrangements are agreed to in writing by the COR. Submit reports of tests that fail to meet construction contract requirements on colored paper.
- D. Verbal Reports: Give verbal notification to COR immediately of any irregularity.

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

## **PART 3 - EXECUTION**

### **3.1 CONCRETE:**

- A. Batch Plant Inspection and Materials Testing:
  - 1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of COR with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by COR.
  - 2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to COR.
  - 3. Sample and test mix ingredients as necessary to insure compliance with specifications.
  - 4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
  - 5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.
- B. Field Inspection and Materials Testing:
  - 1. Provide a technician at site of placement at all times to perform concrete sampling and testing.

2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor's expense. Any rejected concrete that is placed will be subject to removal.
3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 40 m<sup>3</sup> (50 cubic yards) or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. After good concrete quality control has been established and maintained as determined by COR make three cylinders for each 80 m<sup>3</sup> (100 cubic yards) or less of each concrete type, and at least three cylinders from any one day's pour for each concrete type. Label each cylinder with an identification number. COR may require additional cylinders to be molded and cured under job conditions.
4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day's pumping operations to determine change in slump.
5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 m<sup>3</sup> (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m<sup>3</sup> (100 cubic yards) at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
9. Verify that specified mixing has been accomplished.
10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
  - a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
  - b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative

humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.

11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
  12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
  13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
  14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
  15. Observe preparations for placement of concrete:
    - a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
    - b. Inspect preparation of construction, expansion, and isolation joints.
  16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
  17. Observe concrete mixing:
    - a. Monitor and record amount of water added at project site.
    - b. Observe minimum and maximum mixing times.
  18. Measure concrete flatwork for levelness and flatness as follows:
    - a. Perform Floor Tolerance Measurements  $F_F$  and  $F_L$  in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
    - b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
    - c. Provide the Contractor and the COR with the results of all profile tests, including a running tabulation of the overall  $F_F$  and  $F_L$  values for all slabs installed to date, within 72 hours after each slab installation.
  19. Other inspections:
    - a. Grouting under base plates.
    - b. Grouting anchor bolts and reinforcing steel in hardened concrete.
- C. Laboratory Tests of Field Samples:
1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by COR. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of

- improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.
2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.
  3. Furnish certified compression test reports (duplicate) to COR. In test report, indicate the following information:
    - a. Cylinder identification number and date cast.
    - b. Specific location at which test samples were taken.
    - c. Type of concrete, slump, and percent air.
    - d. Compressive strength of concrete in MPa (psi).
    - e. Weight of lightweight structural concrete in  $\text{kg/m}^3$  (pounds per cubic feet).
    - f. Weather conditions during placing.
    - g. Temperature of concrete in each test cylinder when test cylinder was molded.
    - h. Maximum and minimum ambient temperature during placing.
    - i. Ambient temperature when concrete sample in test cylinder was taken.
    - j. Date delivered to laboratory and date tested.

### **3.2 REINFORCEMENT:**

- A. Review mill test reports furnished by Contractor.
- B. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.
- C. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.
- D. Perform tension tests of mechanical and welded splices in accordance with ASTM A370.

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

**PART 1 – GENERAL**

**1.1 DESCRIPTION**

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

**1.2 RELATED WORK**

- A. Section 02 41 00, DEMOLITION.
- B. Section 01 00 00, GENERAL REQUIREMENTS.

### **1.3 QUALITY ASSURANCE**

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
1. Excess or unusable construction materials.
  2. Packaging used for construction products.
  3. Poor planning and/or layout.
  4. Construction error.
  5. Over ordering.
  6. Weather damage.
  7. Contamination.
  8. Mishandling.
  9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.wbdg.org/tools/cwm.php> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.
- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- 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.
    - c. The names and locations of mixed debris reuse and recycling facilities or sites.
    - d. The names and locations of trash disposal landfill facilities or sites.
    - e. Documentation that the facilities or sites are approved to receive the materials.
- C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

### **1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.
- B. U.S. Green Building Council (USGBC):  
LEED Green Building Rating System for New Construction

## **1.7 RECORDS**

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

## **PART 2 – PRODUCTS**

### **2.1 MATERIALS**

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

## **PART 3 – EXECUTION**

### **3.1 COLLECTION**

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

### **3.2 DISPOSAL**

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

### **3.3 REPORT**

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.
- B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.
- C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

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--- E N D ---

**SECTION 02 41 00  
DEMOLITION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies demolition and removal of buildings, portions of buildings, utilities, other structures and debris from trash dumps.

**1.2 RELATED WORK:**

- A. Safety Requirements: Section 01 35 26 Safety Requirements Article, ACCIDENT PREVENTION PLAN (APP).
- B. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- C. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Construction Waste Management: Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT.
- E. Infectious Control: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7, INFECTION PREVENTION MEASURES.

**1.3 PROTECTION:**

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

1. No wall or part of wall shall be permitted to fall outwardly from structures.
  2. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
  3. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items shall be repaired or replaced as approved by the COR. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have the COR's approval.
- H. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- I. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, and Article 1.7 INFECTION PREVENTION MEASURES.

#### **1.4 UTILITY SERVICES:**

- A. Demolish and remove outside utility service lines shown to be removed.
- B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

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

## **PART 3 – EXECUTION**

### **3.1 DEMOLITION:**

- A. Completely demolish and remove buildings and structures, including all appurtenances related or connected thereto, as noted below:
  1. As required for installation of new utility service lines.
  2. To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.

- B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the Medical Center to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the COR. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.
- D. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations. All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.
- E. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the COR. When Utility lines are encountered that are not indicated on the drawings, the COR shall be notified prior to further work in that area.

### **3.2 CLEAN-UP:**

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

--- E N D ---

**SECTION 04 05 16  
MASONRY GROUTING**

**PART 1 – GENERAL**

**1.1 DESCRIPTION:**

Section specifies grout materials and mixes.

**1.2 RELATED WORK:**

- A. Grout used in Section:
  - 1. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

**1.3 TESTS:**

- A. Test grout and materials specified.
- B. Certified test reports.
- C. Identify materials by type, brand name and manufacturer or by origin.
- D. Do not use materials until laboratory test reports are approved by the COR.
- E. After tests have been made and materials approved, do not change without additional test and approval of the COR.
- F. Testing:
  - 1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:
  - 2. Grout:
    - a. Test for compressive strength; ASTM C1019.
    - b. Grout compressive strength of 13790 kPa (2000 psi) at 28 days.
  - 3. Cement:
    - a. Test for water soluble alkali (non-staining) when non-staining cement is specified.
    - b. Non-staining cement shall contain not more than 0.03 percent water soluble alkali.
  - 4. Sand: Test for deleterious substances, organic impurities, soundness and grading.

**1.4 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Certificates:
  - 1. Indicating that following items meet specifications:
    - a. Portland cement.
    - b. Masonry cement.
    - c. Grout.



- d. Hydrated lime.
- e. Fine aggregate (sand).
- f. Coarse aggregate for grout.
- g. Color admixture.
- C. Laboratory Test Reports:
  - 1. Grout, each type.
  - 2. Admixtures.
- D. Manufacturer's Literature and Data:
  - 1. Cement, each kind.
  - 2. Hydrated lime.
  - 3. Admixtures.
  - 4. Liquid acrylic resin.

#### **1.5 PRODUCT DELIVERY, STORAGE AND HANDLING:**

- A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.
- B. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

#### **1.6 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C40-04 ..... Organic Impurities in Fine Aggregates for Concrete
  - C91-05 ..... Masonry Cement
  - C150-09 ..... Portland Cement
  - C207-06 ..... Hydrated Lime for Masonry Purposes
  - C404-07 ..... Aggregate for Masonry Grout
  - C476-10 ..... Grout for Masonry
  - C595-10 ..... Blended Hydraulic Cement
  - C979-10 ..... Pigments for Integrally Colored Concrete
  - C1019-11 ..... Sampling and Testing Grout

### **PART 2 - PRODUCTS**

#### **2.1 HYDRATED LIME:**

ASTM C207, Type S.

#### **2.2 AGGREGATE FOR MASONRY GROUT:**

ASTM C404, Size 8.

**2.3 BLENDED HYDRAULIC CEMENT:**

ASTM C595, Type IS, IP.

**2.4 MASONRY CEMENT:**

A. ASTM C91. Type N, S, or M.

**2.5 PORTLAND CEMENT:**

A. ASTM C150, Type I.

**2.6 LIQUID ACRYLIC RESIN:**

A formulation of acrylic polymers and modifiers in liquid form designed for use as an additive for mortar to improve physical properties.

**2.7 WATER:**

Potable, free of substances that are detrimental to grout, masonry, and metal.

**2.8 GROUT:**

- A. Conform to ASTM C476 except as specified.
- B. Grout type proportioned by volume as follows:
  - 1. Fine Grout:
    - a. Portland cement or blended hydraulic cement: one part.
    - b. Hydrated lime: 0 to 1/10 part.
    - c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.
  - 2. Coarse Grout:
    - a. Portland cement or blended hydraulic cement: one part.
    - b. Hydrated lime: 0 to 1/10 part.
    - c. Fine aggregate: 2-1/4 to three times sum of volumes of cement and lime used.
    - d. Coarse aggregate: one to two times sum of volumes of cement and lime used.
  - 3. Sum of volumes of fine and coarse aggregates: Do not exceed four times sum of volumes of cement and lime used.

**2.9 COLOR ADMIXTURE:**

- A. Pigments: ASTM C979.
- B. Use mineral pigments only. Organic pigments are not acceptable.
- C. Pigments inert, stable to atmospheric conditions, nonfading, alkali resistant and water insoluble.

**PART 3 – EXECUTION**

**3.1 MIXING:**

- A. Mix in a mechanically operated grout mixer.
  - 1. Mix grout for at least five minutes.
- B. Measure ingredients by volume. Measure by the use of a container of known capacity.

- C. Mix water with grout dry ingredients in sufficient amount to bring grout mixture to a pouring consistency.

**3.2 GROUT USE LOCATIONS:**

- A. Use fine grout for filling wall cavities and cells of concrete masonry units where the smallest dimension is 50 mm (2 inches) or less.
- B. Use either fine grout or coarse grout for filling wall cavities and cells of concrete masonry units where the smallest dimension is greater than 50 mm (2 inches).
- C. Do not use grout for filling bond beam or lintel units.
- D. Repair of existing CMU/masonry walls and components.

--- E N D ---

**SECTION 06 10 00  
ROUGH CARPENTRY**

**PART 1 – GENERAL**

**1.1 DESCRIPTION:**

- A. This section specifies wood blocking, framing, sheathing, nailers, rough hardware, and light wood construction.

**1.2 RELATED WORK:**

- A. Gypsum sheathing: Section 09 29 00, GYPSUM BOARD.

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings showing framing connection details, fasteners, connections and dimensions.
- C. Manufacturer's Literature and Data:
  - 1. Submit data for lumber, panels, hardware and adhesives.
  - 2. Submit data for wood-preservative treatment from chemical treatment manufacturer and certification from treating plants that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
  - 3. Submit data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
  - 4. For products receiving a waterborne treatment, submit statement that moisture content of treated materials was reduced to levels specified before shipment to project site.
- D. Manufacturer's certificate for unmarked lumber.

**1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:**

- A. Protect lumber and other products from dampness both during and after delivery at site.
- B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.
- C. Stack plywood and other board products so as to prevent warping.
- D. Locate stacks on well drained areas, supported at least 152 mm (6 inches) above grade and cover with well-ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

**1.5 QUALITY ASSURANCE:**

- A. Installer: A firm with a minimum of three (3) years' experience in the type of work required by this section.

## 1.6 GRADING AND MARKINGS:

- A. Any unmarked lumber or plywood panel for its grade and species will not be allowed on VA Construction sites for lumber and material not normally grade marked, provide manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material meet the specified the specified requirements.

## 1.7 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Forest and Paper Association (AFPA):  
NDS-15 ..... National Design Specification for Wood Construction  
WCD1-01 ..... Details for Conventional Wood Frame Construction
- C. American Institute of Timber Construction (AITC):  
A190.1-07..... Structural Glued Laminated Timber
- D. American Society of Mechanical Engineers (ASME):  
B18.2.1-12(R2013)..... Square and Hex Bolts and Screws  
B18.2.2-10..... Square and Hex Nuts  
B18.6.1-81(R2008)..... Wood Screws
- E. American Plywood Association (APA):  
E30-11..... Engineered Wood Construction Guide
- F. ASTM International (ASTM):  
A653/A653M-13 ..... Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated  
(Galvannealed) by the Hot Dip Process  
C954-11 ..... Steel Drill Screws for the Application of Gypsum Board or Metal  
Plaster Bases to Steel Studs from 0.033 inch (2.24 mm) to  
0.112-inch (2.84 mm) in thickness  
C1002-14 ..... Steel Self-Piercing Tapping Screws for the Application of  
Gypsum Panel Products or Metal Plaster Bases to Wood Studs  
or Metal Studs  
D198-14 ..... Test Methods of Static Tests of Lumber in Structural Sizes  
D2344/D2344M-13..... Test Method for Short-Beam Strength of Polymer Matrix  
Composite Materials and Their Laminates  
D2559-12a ..... Adhesives for Structural Laminated Wood Products for Use  
Under Exterior (Wet Use) Exposure Conditions  
D3498-03(R2011) ..... Adhesives for Field-Gluing Plywood to Lumber Framing for Floor  
Systems  
D6108-13 ..... Test Method for Compressive Properties of Plastic Lumber and  
Shapes

- D6109-13 ..... Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber and Related Products
- D6111-13a ..... Test Method for Bulk Density and Specific Gravity of Plastic Lumber and Shapes by Displacement
- D6112-13 ..... Test Methods for Compressive and Flexural Creep and Creep-Rupture of Plastic Lumber and Shapes
- F844-07a(R2013)..... Washers, Steel, Plan (Flat) Unhardened for General Use
- F1667-13 ..... Nails, Spikes, and Staples
- G. American Wood Protection Association (AWPA):
  - AWPA Book of Standards
- H. Commercial Item Description (CID):
  - A-A-55615 ..... Shield, Expansion (Wood Screw and Lag Bolt Self Threading Anchors)
- I. Forest Stewardship Council (FSC):
  - FSC-STD-01-001(Ver. 4-0) FSC Principles and Criteria for Forest Stewardship
- J. Military Specification (Mil. Spec.):
  - MIL-L-19140E ..... Lumber and Plywood, Fire-Retardant Treated
- K. Environmental Protection Agency (EPA):
  - 40 CFR 59(2014) ..... National Volatile Organic Compound Emission Standards for Consumer and Commercial Products
- L. Truss Plate Institute (TPI):
  - TPI-85..... Metal Plate Connected Wood Trusses
- M. U.S. Department of Commerce Product Standard (PS)
  - PS 1-95 ..... Construction and Industrial Plywood
  - PS 20-10 ..... American Softwood Lumber Standard
- N. ICC Evaluation Service (ICC ES):
  - AC09 ..... Quality Control of Wood Shakes and Shingles
  - AC174 ..... Deck Board Span Ratings and Guardrail Systems (Guards and Handrails)

## **PART 2 – PRODUCTS**

### **2.1 LUMBER:**

- A. Unless otherwise specified, each piece of lumber must bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.

1. Identifying marks are to be in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.
- B. Structural Members: Species and grade as listed in the AFPA NDS having design stresses as shown.
- C. Lumber Other Than Structural:
  1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
  2. Framing lumber: Minimum extreme fiber stress in bending of 7584 kPa (1100 PSI).
  3. Furring, blocking, nailers and similar items 101 mm (4 inches) and narrower Standard Grade; and, members 152 mm (6 inches) and wider, Number 2 Grade.
  4. Board Sub-flooring: Shiplap edge, 25 mm (1 inch) thick, not less than 203 mm (8 inches) wide.
- D. Sizes:
  1. Conforming to PS 20.
  2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.
- E. Moisture Content:
  1. Maximum moisture content of wood products is to be as follows at the time of delivery to site.
    - a. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
    - b. Lumber over 50 mm (2 inches) thick: 25 percent or less.
- F. Fire Retardant Treatment:
  1. Comply with Mil Spec. MIL-L-19140.
  2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.
- G. Preservative Treatment:
  1. Do not treat Heart Redwood and Western Red Cedar.
  2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 610 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members provided in connection with roofing and flashing materials.
  3. Treat other members specified as preservative treated (PT).

4. Preservative treat by the pressure method complying with AWPA Book use category system standards U1 and T1, except any process involving the use of Chromated Copper Arsenate (CCA) or other agents classified as carcinogenic for pressure treating wood is not permitted.

### **2.3 PLYWOOD:**

- A. Comply with PS 1.
- B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.
- C. Wall and Floor Sheathing:
  1. APA Exterior grade CD or better.
  2. Wall sheathing:
    - a. Minimum 9 mm (11/32 inch) thick with supports 406 mm (16 inches) on center and 12 mm (15/32 inch) thick with supports 610 mm (24 inches) on center unless specified otherwise.
    - b. Minimum 1200 mm (48 inches) wide at corners without corner bracing of framing.

### **2.4 ROUGH HARDWARE AND ADHESIVES:**

- A. Anchor Bolts:
  1. ASME B18.2.1 and ASME B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
  2. Extend at least 203 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).
- B. Miscellaneous Bolts: Expansion Bolts: C1D A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Provide 13 mm (1/2 inch) bolt unless shown otherwise.
- C. Washers
  1. ASTM F844.
  2. Provide zinc or cadmium coated steel or cast iron for washers exposed to weather.
- D. Screws:
  1. Wood to Wood: ASME B18.6.1 or ASTM C1002.
  2. Wood to Steel: ASTM C954, or ASTM C1002.
- E. Nails:
  1. Size and type best suited for purpose unless noted otherwise. Provide aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
  2. ASTM F1667:
    - a. Common: Type I, Style 10.
    - b. Concrete: Type I, Style 11.
    - c. Barbed: Type I, Style 26.



- d. Underlayment: Type I, Style 25.
- e. Masonry: Type I, Style 27.
- f. Provide special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.

## **PART 3 – EXECUTION**

### **3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:**

- A. Conform to applicable requirements of the following:
  - 1. AFPA NDS for timber connectors.
  - 2. AITC A190.1 Timber Construction Manual for heavy timber construction.
  - 3. AFPA WCD1 for nailing and framing unless specified otherwise.
  - 4. APA for installation of plywood or structural use panels.
  - 5. TPI for metal plate connected wood trusses.
- B. Fasteners:
  - 1. Nails.
    - a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA WCD1 where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
    - b. Use special nails with framing connectors.
    - c. For sheathing and subflooring, select length of nails sufficient to extend 25 mm (1 inch) into supports.
    - d. Use 8d or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.
    - e. Use 16d or larger nails for nailing through 50 mm (2 inch) thick lumber.
    - f. Select the size and number of nails in accordance with the Nailing Schedule except for special nails with framing anchors.
    - g. Nailing Schedule; Using Common Nails:
      - 1) Joist bearing on sill or girder, toe nail three (3) 8d nails or framing anchor.
      - 2) Bridging to joist, toe nail each end two (2) 8d nails.
      - 3) Ledger strip to beam or girder three (3) 16d nails under each joint.
      - 4) Subflooring or Sheathing:
        - a) 152 mm (6 inch) wide or less to each joist face nail two (2) 8d nails.
        - b) Subflooring, more than 152 mm (6 inches) wide, to each stud or joint, face nail three (3) 8d nails.

- c) Plywood or structural use panel to each stud or joist face nail 8d, at supported edges 152 mm (6 inches) on center and at intermediate supports 254 mm (10 inches) on center. When gluing plywood to joint framing increase nail spacing to 305 mm (12 inches) at supported edges and 508 mm (20 inches) o.c. at intermediate supports.
  - 5) Sole plate to joist or blocking, through sub floor face nail 20d nails, 406 mm (16 inches) on center.
  - 6) Top plate to stud, end nail two (2) 16d nails.
  - 7) Stud to sole plate, toe nail or framing anchor. Four (4) 8d nails.
  - 8) Doubled studs, face nail 16d at 610 mm (24 inches) on center.
  - 9) Built-up corner studs 16d at 610 mm (24 inches) (24 inches) on center.
  - 10) Doubled top plates, face nails 16d at 406 mm (16 inches) on center.
  - 11) Top plates, laps, and intersections, face nail two (2) 16d.
  - 12) Continuous header, two pieces 16d at 406 mm (16 inches) on center along each edge.
  - 13) Ceiling joists to plate, toenail three (3) 8d or framing anchor.
  - 14) Continuous header to stud, four (4) 16d.
  - 15) Ceiling joists, laps over partitions, face nail three (3) 16d or framing anchor.
  - 16) Ceiling joists, to parallel rafters, face nail three (3) 16d.
  - 17) Rafter to plate, toe nail three (3) 8d or framing anchor. Brace 25 mm (1 inch) thick board to each stud and plate, face nail three (3) 8d.
  - 18) Built-up girders and beams 20d at 812 mm (32 inches) on center along each edge.
2. Bolts:
- a. Fit bolt heads and nuts bearing on wood with washers.
  - b. Countersink bolt heads flush with the surface of nailers.
  - c. Embed in concrete and solid masonry or provide expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
  - d. Provide toggle bolts to hollow masonry or sheet metal.
  - e. Provide bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 610 mm (24 inch) intervals between end bolts. Provide clips to beam flanges.
3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
- a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
  - b. ASTM C954 for steel over 0.84 mm (0.033 inch) thick.
4. Power actuated drive pins may be provided where practical to anchor to solid masonry, concrete, or steel.

5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Provide metal plugs, inserts or similar fastening.
6. Screws to Join Wood:
  - a. Where shown or option to nails.
  - b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
  - c. Spaced same as nails.
- C. Set sills or plates level in full bed of mortar on masonry or concrete walls.
  1. Space anchor bolts 1219 mm (4 feet) on centers between ends and within 152 mm (6 inches) of end. Stagger bolts from side to side on plates over 178 mm (7 inches) in width.
  2. Provide shims of slate, tile or similar approved material to level wood members resting on concrete or masonry. Do not use wood shims or wedges.
  3. Closely fit, and set to required lines.
- D. Cut notch, or bore in accordance with AFPA WCD1 passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.
- E. Blocking Nailers, and Furring:
  1. Install furring, blocking, nailers, and grounds where shown.
  2. Provide longest lengths practicable.
  3. Provide fire retardant treated wood blocking where shown at openings and where shown or specified.
4. Layers of Blocking or Plates:
  - a. Stagger end joints between upper and lower pieces.
  - b. Nail at ends and not over 610 mm (24 inches) between ends.
  - c. Stagger nails from side to side of wood member over 127 mm (5 inches) in width.
- F. Partition and Wall Framing:
  1. Provide 50 mm by 101 mm (2 inch by 4 inch) studs spaced 406 mm (16 inches) on centers; unless otherwise indicated on contract documents.
  2. Install double studs at openings and triple studs at corners.
  3. Installation of sole plate:
    - a. Anchor plates of walls or partitions resting on concrete floors in place with expansion bolts, one (1) near ends of piece and at intermediate intervals of not more than 1219 mm (4 feet) or with power actuated drive pins with threaded ends of suitable type and size, spaced 610 mm (2 feet) on center unless shown otherwise.
    - b. Nail plates to wood framing through subfloor as specified in nailing schedule.
- G. Headers or Lintels:

- a. Make headers for openings of two (2) pieces of 50 mm (2 inch) thick lumber of size shown with plywood filler to finish flush with face of studs or solid lumber of equivalent size.
  - b. Support ends of headers on top of stud cut for height of opening. Spike cut stud to adjacent stud. Spike adjacent stud to header.
5. Provide double top plates, with members lapped at least 610 mm (2-feet) spiked together.
6. Install intermediate cut studs over headers and under sills to maintain uniformity of stud spacing.
7. Provide single sill plates at bottom of opening unless otherwise indicated in contract documents. Toe nail to end stud, face nail to intermediate studs.
8. Install 50 mm (2 inch) blocking for fire stopping so that maximum dimension of any concealed space is not over 2438 mm (8 feet) in accordance with AFPA WCD1.
9. Install corner bracing when plywood or structured use panel sheathing is not used.
  - a. Let corner bracing into exterior surfaces of studs at an angle of approximately 45 degrees, extended completely over walls plates, and secured at bearing with two (2) nails.
  - b. Provide 25 mm by 101 mm (1 inch by 4 inch) corner bracing.

--- E N D ---

**SECTION 07 21 13  
THERMAL INSULATION**

**PART 1 – GENERAL**

**1.1 DESCRIPTION:**

- A. This section specifies thermal and acoustical insulation for buildings.
- B. Acoustical insulation is identified by thickness and words "Acoustical Insulation".

**1.2 RELATED WORK**

- A. Safing insulation: Section 07 84 00, FIRESTOPPING.

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES .
- B. Manufacturer's Literature and Data:
  - 1. Insulation, each type used
  - 2. Adhesive, each type used.
  - 3. Tape
- C. Certificates: Stating the type, thickness and "R" value (thermal resistance) of the insulation to be installed.

**1.4 STORAGE AND HANDLING:**

- A. Store insulation materials in weathertight enclosure.
- B. Protect insulation from damage from handling, weather and construction operations before, during, and after installation.

**1.5 APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - C270-10 .....Mortar for Unit Masonry
  - C516-08 .....Vermiculite Loose Fill Thermal Insulation
  - C549-06 .....Perlite Loose Fill Insulation
  - C552-07 .....Cellular Glass Thermal Insulation.
  - C553-08 .....Mineral Fiber Blanket Thermal Insulation for Commercial and  
Industrial Applications
  - C578-10 .....Rigid, Cellular Polystyrene Thermal Insulation
  - C591-09 .....Unfaced Preformed Rigid Cellular Polyisocyanate Thermal  
Insulation
  - C612-10 .....Mineral Fiber Block and Board Thermal Insulation

- C665-06 .....Mineral Fiber Blanket Thermal Insulation for Light Frame  
 Construction and Manufactured Housing
- C728-05 (R2010) .....Perlite Thermal Insulation Board
- C954-10 .....Steel Drill Screws for the Application of Gypsum Panel Products  
 or Metal Plaster Base to Steel Studs From 0.033 (0.84 mm) inch  
 to 0.112 inch (2.84 mm) in thickness
- C1002-07 .....Steel Self-Piercing Tapping Screws for the Application of  
 Gypsum Panel Products or Metal Plaster Bases to Wood Studs  
 or Steel Studs
- D312-00(R2006) .....Asphalt Used in Roofing
- E84-10.....Surface Burning Characteristics of Building Materials
- F1667-11.....Driven Fasteners: Nails, Spikes and Staples.

## PART 2 - PRODUCTS

### 2.1 INSULATION – GENERAL:

- A. Where thermal resistance ("R" value) is specified or shown for insulation, the thickness shown on the drawings is nominal. Use only insulation with actual thickness that is not less than that required to provide the thermal resistance specified or conditions complying with ASHRAE 90.1.
- B. Where "R" value is not specified for insulation, use the thickness shown on the drawings.
- C. Where more than one type of insulation is specified, the type of insulation for each use is optional, except use only one type of insulation in any particular area.
- D. Insulation Products shall comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Perlite composite board	23 percent post-consumer recovered paper
Polyisocyanate/polyurethane	
Rigid foam	9 percent recovered material
Foam-in-place	5 percent recovered material
Glass fiber reinforced	6 percent recovered material
Phenolic rigid foam	5 percent recovered material
Rock wool material	75 percent recovered material

The minimum-content standards are based on the weight (not the volume)  
 of the material in the insulating core only.

## **2.2 ACOUSTICAL INSULATION:**

- A. Mineral Fiber Batt or Blankets: ASTM C665. Maximum flame spread of 25 and smoke development of 450 when tested in accordance with ASTM E84.
- C. Thickness as shown; of widths and lengths to fit tight against framing.

## **2.3 FASTENERS:**

- A. Staples or Nails: ASTM F1667, zinc-coated, size and type best suited for purpose.
- B. Screws: ASTM C954 or C1002, size and length best suited for purpose with washer not less than 50 mm (two inches) in diameter.
- C. Impaling Pins: Steel pins with head not less than 50 mm (two inches) in diameter with adhesive for anchorage to substrate. Provide impaling pins of length to extend beyond insulation and retain cap washer when washer is placed on the pin.

## **2.4 ADHESIVE:**

- A. As recommended by the manufacturer of the insulation.
- B. Asphalt: ASTM D312, Type III or IV.
- C. Mortar: ASTM C270, Type 0.

## **2.5 TAPE:**

- A. Pressure sensitive adhesive on one face.
- B. Perm rating of not more than 0.50.

# **PART 3 – EXECUTION**

## **3.1 INSTALLATION - GENERAL**

- A. Install insulation with the vapor barrier facing the heated side, unless specified otherwise.
- B. Install rigid insulating units with joints close and flush, in regular courses and with cross joints broken.
- C. Install batt or blanket insulation with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape.
- D. Fit insulation tight against adjoining construction and penetrations, unless specified otherwise.

## **3.2 ACOUSTICAL INSULATION:**

- A. Fasten blanket insulation between metal studs and wall furring with continuous pressure sensitive tape along edges or adhesive.
- B. Pack insulation around door frames and windows and in cracks, expansion joints, control joints, door soffits and other voids. Pack behind outlets, around pipes, ducts, and services encased in wall or partition. Hold insulation in place with pressure sensitive tape or adhesive.
- C. Do not compress insulation below required thickness except where embedded items prevent required thickness.

- D. Where acoustical insulation is installed above suspended ceilings install blanket at right angles to the main runners or framing. Extend insulation over wall insulation systems not extending to structure above.
- E. Where semi-rigid insulation is used which is not full thickness of cavity, adhere to one side of cavity maintaining continuity of insulation and covering penetrations or embedment in insulation.

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

**1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.  
PART 2 - PRODUCTS.
- C. Installer qualifications.
- D. Inspector qualifications.
- E. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.
- F. List of FM, UL, or WH classification number of systems installed.
- G. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.
- H. Submit certificates from manufacturer attesting that firestopping materials comply with the specified requirements.

**1.4 DELIVERY AND STORAGE:**

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

**1.5 QUALITY ASSURANCE:**

- A. FM, UL, or WH or other approved laboratory tested products will be acceptable.
- B. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991 or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements." Submit qualification data.
- C. Inspector Qualifications: Contractor to engage a qualified inspector to perform inspections and final reports. The inspector to meet the criteria contained in ASTM E699 for agencies involved in

quality assurance and to have a minimum of two years' experience in construction field inspections of firestopping systems, products, and assemblies. The inspector to be completely independent of, and divested from, the Contractor, the installer, the manufacturer, and the supplier of material or item being inspected. Submit inspector qualifications.

## **1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. ASTM International (ASTM):
  - E84-14..... Surface Burning Characteristics of Building Materials
  - E699-09..... Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components
  - E814-13a..... Fire Tests of Through-Penetration Fire Stops
  - E2174-14..... Standard Practice for On-Site Inspection of Installed Firestops
  - E2393-10a..... Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
- C. FM Global (FM):
  - Annual Issue Approval Guide Building Materials
  - 4991-13 ..... Approval of Firestop Contractors
- D. Underwriters Laboratories, Inc. (UL):
  - Annual Issue Building Materials Directory
  - Annual Issue Fire Resistance Directory
  - 723-10(2008)..... Standard for Test for Surface Burning Characteristics of Building Materials
  - 1479-04(R2014) ..... Fire Tests of Through-Penetration Firestops
- E. Intertek Testing Services - Warnock Hersey (ITS-WH):
  - Annual Issue Certification Listings
- F. Environmental Protection Agency (EPA):
  - 40 CFR 59(2014) ..... National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

## **PART 2 – PRODUCTS**

### **2.1 FIRESTOP SYSTEMS:**

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

- B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 101 mm (4 in.) nominal pipe or 0.01 sq. m (16 sq. in.) in overall cross sectional area.
- C. Products requiring heat activation to seal an opening by its intumescence are not permitted by VA Fire and Safety for use in firestop systems.
- D. 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.
- E. 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.
- F. 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.
- G. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.
- H. 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.
- I. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
  - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
  - 2. For floor penetrations with annular spaces exceeding 101 mm (4 in.) or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the

floor loads involved either by installing floor plates or by other means acceptable to the firestop manufacturer.

3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

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

- A. Provide silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.
- B. Provide mineral fiber filler and bond breaker behind sealant.
- C. Sealants to have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with ASTM E84.
- D. When used in exposed areas capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION:**

- A. Submit product data and installation instructions, as required by article, submittals, after an on-site examination of areas to receive firestopping.
- B. Examine substrates and conditions with installer present for compliance with requirements for opening configuration, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **3.2 PREPARATION:**

- A. Remove dirt, grease, oil, laitance and form-release agents from concrete, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.
- B. Remove insulation on insulated pipe for a distance of 150 mm (6 inches) on each side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.
- C. Prime substrates where required by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- D. Masking Tape: Apply masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing seal of firestopping with substrates.

### **3.3 INSTALLATION:**

- A. Do not begin firestopping work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.
- B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.
- C. Install smoke stopping seals in smoke partitions.
- D. Label all sealed thru-wall penetrations with approved UL, WH or FM rated assembly designation. Labels will be placed on the wall above the ceiling adjacent to each sealed penetration. Letters and numbers will be no smaller than one inch in a color and font approved by the COR.

### **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.

**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 elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
  - 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.
- D. 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.

**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.  
PART 2 - PRODUCTS.
- C. Installer qualifications.
- D. Contractor certification.
- E. Manufacturer's installation instructions for each product used.
- F. Cured samples of exposed sealants for each color.
- G. Manufacturer's Literature and Data:
  - 1. Primers
  - 2. Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- H. Manufacturer warranty.

**1.6 PROJECT CONDITIONS:**

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

**1.7 DELIVERY, HANDLING, AND STORAGE:**

- A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.
- B. Carefully handle and store to prevent inclusion of foreign materials.

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

#### **1.8 DEFINITIONS:**

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

#### **1.9 WARRANTY:**

- A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".
- B. Manufacturer Warranty: Manufacturer shall warranty their sealant for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty.

#### **1.10 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. ASTM International (ASTM):
  - C509-06 .....Elastomeric Cellular Preformed Gasket and Sealing Material
  - C612-14 .....Mineral Fiber Block and Board Thermal Insulation
  - C717-14a .....Standard Terminology of Building Seals and Sealants
  - C734-06(R2012) .....Test Method for Low-Temperature Flexibility of Latex Sealants  
after Artificial Weathering
  - C794-10 .....Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
  - C919-12. ....Use of Sealants in Acoustical Applications.
  - C920-14a .....Elastomeric Joint Sealants.
  - C1021-08(R2014) .....Laboratories Engaged in Testing of Building Sealants
  - C1193-13 .....Standard Guide for Use of Joint Sealants.
  - C1248-08(R2012) .....Test Method for Staining of Porous Substrate by Joint Sealants
  - C1330-02(R2013) .....Cylindrical Sealant Backing for Use with Cold Liquid Applied  
Sealants
  - C1521-13 .....Standard Practice for Evaluating Adhesion of Installed  
Weatherproofing Sealant Joints
  - D217-10 .....Test Methods for Cone Penetration of Lubricating Grease
  - D412-06a(R2013) .....Test Methods for Vulcanized Rubber and Thermoplastic  
Elastomers-Tension
  - D1056-14 .....Specification for Flexible Cellular Materials—Sponge or  
Expanded Rubber
  - E84-09.....Surface Burning Characteristics of Building Materials



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

The Professionals' Guide

D. Environmental Protection Agency (EPA):

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

## **PART 2 - PRODUCTS**

### **2.1 SEALANTS:**

A. Exterior Sealants:

1. S-1 Vertical surfaces, provide non-staining ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
2. S-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. Wood to masonry.
  - g. Masonry joints where shelf angles occur.
  - h. Voids where items penetrate exterior walls.
  - i. 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. S-3 Vertical and Horizontal Surfaces: ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
3. 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.
- D. Acoustical Sealant:
- 1. Conforming to ASTM C919; flame spread of 25 or less; and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Acoustical sealant have a consistency of 250 to 310 when tested in accordance with ASTM D217; remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734; and be non-staining.
  - 2. Provide location(s) of acoustical sealant as follows:
    - a. Exposed acoustical joint at sound rated partitions.
    - b. Concealed acoustic joints at sound rated partitions.
    - c. Joints where item pass-through sound rated partitions.

## **2.2 COLOR:**

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

## **2.3 JOINT SEALANT BACKING:**

- A. General: Provide sealant backings of material and type that are non-staining; 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.

**2.4 FILLER:**

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

**2.5 PRIMER:**

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

**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 5 degrees C and 38 degrees C (40 degrees and 100 degrees F).

2. Do not install polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
  3. Do not install sealant type listed by manufacture as not suitable for use in locations specified.
  4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
  5. Avoid dropping or smearing compound on adjacent surfaces.
  6. Fill joints solidly with compound and finish compound smooth.
  7. Tool exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 5A in ASTM C1193 unless shown or specified otherwise in construction documents. Remove masking tape immediately after tooling of sealant and before sealant face starts to "skin" over. Remove any excess sealant from adjacent surfaces of joint, leaving the working in a clean finished condition.
  8. Finish paving or floor joints flush unless joint is otherwise detailed.
  9. Apply compounds with nozzle size to fit joint width.
  10. Test sealants for compatibility with each other and substrate. Use only compatible sealant. Submit test reports.
  11. Replace sealant which is damaged during construction process.
- B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise. Take all necessary steps to prevent three-sided adhesion of sealants.
- C. 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.

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

- A. 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.
- B. Inspect tested joints and report on following:

1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
  2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
  3. Whether sealants filled joint cavities and are free from voids.
  4. Whether sealant dimensions and configurations comply with specified requirements.
- D. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
- E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.
- F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### **3.7 CLEANING:**

- A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by 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.

--- E N D ---

**SECTION 09 22 16  
NON-STRUCTURAL METAL FRAMING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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, plaster bases 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 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**

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. American Society For Testing And Materials (ASTM)
  - A641-09.....Zinc-Coated (Galvanized) Carbon Steel Wire
  - A653/653M-11.....Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
  - C11-10 ..... Terminology Relating to Gypsum and Related Building Materials and Systems
  - C635-07 ..... Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings
  - C636-08 ..... Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
  - C645-09 ..... Non-Structural Steel Framing Members
  - C754-11 ..... Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
  - C841-03(R2008) ..... Installation of Interior Lathing and Furring
  - C954-10 ..... 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
  - E580-11.....Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint.

## **PART 2 - PRODUCTS**

### **2.1 PROTECTIVE COATING**

Galvanize steel studs, runners (track), rigid (hat section) furring channels, "Z" shaped furring channels, and resilient furring channels, with coating designation of G-60 minimum, per ASTM 123.

### **2.2 STEEL STUDS AND RUNNERS (TRACK)**

- A. ASTM C645, modified for thickness specified and sizes as shown.
  - 1. Use ASTM A653/A653M steel, 0.8 mm (0.0329-inch) thick bare metal (33 mil).
  - 2. Runners same thickness as studs.



- 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.

## **2.3 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. Tie 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.

## **2.4 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 to match existing conditions.
- F. At existing plaster ceilings and where shown, studs may terminate at ceiling to match existing conditions.
- G. 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.
- H. 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.

### **3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY**

- A. Direct attachment to masonry or concrete; rigid channels:
  - 1. Install rigid (hat section) furring channels at 600 mm (24 inches) on center, horizontally or vertically.
  - 2. At corners where rigid furring channels are positioned horizontally, provide mitered joints in furring channels.
  - 3. Ends of spliced furring channels shall be nested not less than 200 mm (8 inches).
  - 4. 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.
- B. 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, , 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 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.)

--- E N D ---

**SECTION 09 29 00  
GYPSUM BOARD**

**PART 1 – GENERAL**

**1.1 DESCRIPTION**

This section specifies installation and finishing of gypsum board.

**1.2 RELATED WORK**

- A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.
- B. Sound deadening board: Section 07 21 13, THERMAL INSULATION.
- C. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.

**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**

In accordance with the requirements of ASTM C840.

## **1.6 ENVIRONMENTAL CONDITIONS**

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):
- C11-08 ..... Terminology Relating to Gypsum and Related Building Materials and Systems
  - C475-02 ..... Joint Compound and Joint Tape for Finishing Gypsum Board
  - C840-08 ..... Application and Finishing of Gypsum Board
  - C919-08 ..... Sealants in Acoustical Applications
  - C954-07 ..... 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
  - C1002-07 ..... Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
  - C1047-05 ..... Accessories for Gypsum Wallboard and Gypsum Veneer Base
  - C1177-06 ..... Glass Mat Gypsum Substrate for Use as Sheathing
  - C1658-06 ..... Glass Mat Gypsum Panels
  - C1396-06 ..... Gypsum Board
  - E84-08..... Surface Burning Characteristics of Building Materials
- 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. Shall contain a minimum of 20 percent recycled gypsum.
- B. Water Resistant Gypsum Backing Board: ASTM C620, Type X, 16 mm (5/8 inch) thick.
- C. Gypsum cores shall contain maximum percentage of post industrial recycled gypsum content available in the area (a minimum of 95 percent post industrial recycled gypsum content). 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).
- 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.
- 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 furring channels to match existing conditions.
  - 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 to 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.
    - d. Install control joints to match existing conditions.
- H. 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.

### **3.3 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.

### **3.5 FINISHING OF GYPSUM BOARD**

- A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 4 finish for all 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 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.

### **3.6 REPAIRS**

- A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including non-decorated 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 existing sound rated construction .

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52109.00

VA250-15-J-0951

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

**PART 1- GENERAL**

**1.1 DESCRIPTION**

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

**1.2 SUBMITTAL**

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

**1.3 DEFINITIONS**

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

**1.4 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A641/A641M-09 .....Zinc-coated (Galvanized) Carbon Steel Wire
  - A653/A653M-11 .....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process
  - C423-09 .....Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
  - C634-11 .....Standard Terminology Relating to Environmental Acoustics
  - C635-13 .....Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

- C636-13 ..... Installation of Metal Ceiling Suspension Systems for Acoustical  
Tile and Lay-in Panels
- E84-13..... Surface Burning Characteristics of Building Materials
- E119-12..... Fire Tests of Building Construction and Materials
- E413-10..... Classification for Rating Sound Insulation.
- E580-11 ..... Application of Ceiling Suspension Systems for Acoustical Tile  
and Lay-in Panels in Areas Requiring Seismic Restraint
- E1264-08e1..... Classification for Acoustical Ceiling Products
- C. International Organization for Standardization (ISO)
  - ISO 14644-1 ..... Classification of Air Cleanliness

## **PART 2- PRODUCTS**

### **2.1 METAL SUSPENSION SYSTEM**

- A. ASTM C635, heavy-duty system, except as otherwise specified.
  - 1. Ceiling suspension system members may be fabricated from material to match existing.
    - a. Galvanized cold-rolled steel, bonderized.
    - b. Extruded aluminum.
  - 2. Use same construction for cross runners as main runners. Use of lighter-duty sections for cross runners is not acceptable.
- B. Exposed grid suspension system for support of lay-in panels to match existing:
  - 1. Exposed grid width not less than 22 mm (7/8 inch) with not less than 8 mm (5/16 inch) panel bearing surface.
  - 2. Fabricate wall molding and other special molding from the same material with same exposed width and finish as the exposed grid members.
  - 3. On exposed metal surfaces apply baked-on enamel flat texture finish in color to match adjacent acoustical units.

### **2.2 PERIMETER SEAL**

- A. Vinyl, polyethylene or polyurethane open cell sponge material having density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.
- B. Thickness as required to fill voids between back of wall molding and finish wall.
- C. Not less than 9 mm (3/8 inch) wide strip.

### **2.3 WIRE**

- A. ASTM A641.
- B. For wire hangers: Minimum diameter 2.68 mm (0.1055 inch).
- C. For bracing wires: Minimum diameter 3.43 mm (0.1350 inch).

## 2.4 ANCHORS AND INSERTS

- A. Use anchors or inserts to support twice the loads imposed by hangers attached thereto.
- B. Hanger Inserts:
  - 1. Fabricate inserts from steel, zinc-coated (galvanized after fabrication).
  - 2. Nailing type option for wood forms:
    - a. Upper portion designed for anchorage in concrete and positioning lower portion below surface of concrete approximately 25 mm (one inch).
    - b. Lower portion provided with not less than 8 mm (5/16 inch) hole to permit attachment of hangers.
  - 3. Flush ceiling insert type:
    - a. Designed to provide a shell covered opening over a wire loop to permit attachment of hangers and keep concrete out of insert recess.
    - b. Insert opening inside shell approximately 16 mm (5/8 inch) wide by 9 mm (3/8 inch) high over top of wire.
    - c. Wire 5 mm (3/16 inch) diameter with length to provide positive hooked anchorage in concrete.
- C. Clips:
  - 1. Galvanized steel.
  - 2. Designed to clamp to steel beam or bar joists, or secure framing member together.
  - 3. Designed to rigidly secure framing members together.
  - 4. Designed to sustain twice the loads imposed by hangers or items supported.
- D. Tile Splines: ASTM C635.

## 2.5 CARRYING CHANNELS FOR SECONDARY FRAMING

- A. Fabricate from cold-rolled or hot-rolled steel, black asphaltic paint finish, free of rust.
- B. Weighing not less than the following, per 300 m (per thousand linear feet):

Size mm	Size Inches	Cold-rolled		Hot-rolled	
		Kg	Pound	Kg	Pound
38	1 1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

## 2.6 ADHESIVE

- A. ASTM D1779, having flame spread index of 25 or less when tested in accordance with ASTM E84.
- B. Developing minimum strength of 7 kg/m<sup>2</sup> (one psi) of contact surface 48 hours after installation in temperature of 21 °C (70 °F).

## 2.7 ACOUSTICAL UNITS

### A. General:

1. Ceiling Tile shall meet minimum 37% bio-based content in accordance with USDA Bio-Preferred Product requirements.
2. ASTM E1264, weighing 3.6 kg/m<sup>2</sup> (3/4 psf) minimum for mineral fiber panels or tile.
3. Class A Flame Spread: ASTM 84
4. Minimum NRC (Noise Reduction Coefficient): 0.55 unless specified otherwise: ASTM C423.
5. Minimum CAC (Ceiling Attenuation Class): 40-44 range unless specified otherwise: ASTM E413.
6. Manufacturers standard finish, minimum Light Reflectance (LR) coefficient of 0.75 on the exposed surfaces.
7. Lay-in panels: Sizes to match existing.
  - b. Panels: Sizes to match existing with flat panel with square edges to finish flush with exposed grid suspension system.
  - c. Sound absorbent element; either non-sifting mineral wool or glass fiber (free of formaldehyde) of density and thickness to provide specified noise reduction coefficient. Enclosure sound absorbent elements within plastic envelopes.
  - d. Support sound absorbent elements on wire spacer about 6 mm (1/4 inch) high. Fit both the sound absorbent element and the spacer into the unit.

- B. Special faced acoustical tile units AT(SP) shall be used for surgery/clean areas, kitchens, SPD and wet areas as per referenced in PG-18-14, Room Finishes, Door, & Hardware Schedule. AT(SP) Special faced acoustical tile units shall provide 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.

- C. Type III Units - Mineral base with water-based painted finish less than 10 g/l VOC, Form 2 - Water felted, minimum 16 mm (5/8 inch) thick. Mineral base to contain minimum 65 percent recycled content.

## 2.8 ACCESS IDENTIFICATION

### A. Markers:

1. Use colored markers with pressure sensitive adhesive on one side.
2. Make colored markers of paper or plastic, 6 to 9 mm (1/4 to 3/8 inch) in diameter.

- B. Use markers of the same diameter throughout building.

- C. Color Code: Use following color markers for service identification:

Color..... Service

Red..... Sprinkler System: Valves and Controls

Green ..... Domestic Water: Valves and Controls

Yellow..... Chilled Water and Heating Water

Orange .....Ductwork: Fire Dampers  
Blue .....Ductwork: Dampers and Controls  
Black.....Gas: Laboratory, Medical, Air and Vacuum

## **PART 3 EXECUTION**

### **3.1 CEILING TREATMENT**

- A. Treatment of ceilings shall include sides and soffits of ceiling beams, furred work 600 mm (24 inches) wide and over, and vertical surfaces at changes in ceiling heights unless otherwise shown. Install acoustic tiles after wet finishes have been installed and solvents have cured.
- B. Lay out acoustical units symmetrically to match all existing conditions.
- C. 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.
- D. Existing ceiling:
  - 1. Where extension of existing ceilings occur, match existing.
  - 2. Where acoustical units are salvaged and reinstalled or joined, use salvaged units within a space. Do not mix new and salvaged units within a space which results in contrast between old and new acoustic units.
  - 3. Comply with specifications for new acoustical units for new units required to match appearance of existing units.

### **3.2 CEILING SUSPENSION SYSTEM INSTALLATION**

- A. General:
  - 1. Install metal suspension system for acoustical tile and lay-in panels in accordance with ASTM C636, to match all existing conditions.
  - 2. Use direct or indirect hung suspension system or combination thereof as defined in ASTM C635.
  - 3. Prevent deflection in excess of 1/360 of span of cross runner and main runner.
  - 4. Use main runners not less than 1200 mm (48 inches) in length.
  - 5. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.
- B. Anchorage to Structure:
  - 1. Concrete:
    - a. 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. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels for attachment of hanger wires.
    - (1) Size and space carrying channels to insure that the maximum deflection specified will not be exceeded.
    - (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 fire proofing is installed. Weld or use steel clips to attach to beam to develop full strength of carrying channel.
  - 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.
- C. Direct Hung Suspension System:
  1. As illustrated in ASTM C635.
  2. Support main runners by hanger wires attached directly to the structure overhead.
  3. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.
- D. Seismic Ceiling Bracing System:
  1. Construct system in accordance with ASTM E580.
  2. Connect bracing wires to structure above as specified for anchorage to structure and to main runner or carrying channels of suspended ceiling at bottom.

### **3.3 ACOUSTICAL UNIT INSTALLATION**

- A. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.
- B. Install lay-in acoustic panels in exposed grid with not less than 6 mm (1/4 inch) bearing at edges on supports.
  1. Install tile to lay level and in full contact with exposed grid.
  2. Replace cracked, broken, stained, dirty, or tile not cut for minimum bearing.
- C. Tile in concealed grid upward access suspension system:
  1. Install acoustical tile with joints close, straight and true to line, and with exposed surfaces level and flush at joints.
  2. Make corners and arises full, and without worn or broken places.
  3. Locate acoustical units providing access as specified under Article, ACCESS.
- E. Markers:



1. Install markers of color code specified to identify the various concealed piping, mechanical, and plumbing systems to match existing condition.

#### **3.4 CLEAN-UP AND COMPLETION**

- A. Replace damaged, discolored, dirty, cracked and broken acoustical units.
- B. Leave finished work free from defects.

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**SECTION 09 91 00  
PAINTING**

**PART 1 – GENERAL**

**1.1 DESCRIPTION:**

- A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the painting and finishing as shown on the construction documents and/or specified herein, including, but not limited to, the following:
1. Prime coats which may be applied in shop under other sections.
  2. Prime painting unprimed surfaces to be painted under this Section.
  3. Painting items furnished with a prime coat of paint, including touching up of or repairing of abraded, damaged or rusted prime coats applied by others.
  4. Painting ferrous metal (except stainless steel) exposed to view.
  5. Painting galvanized ferrous metals exposed to view.
  6. Painting interior concrete block exposed to view.
  7. Painting gypsum drywall exposed to view.
  8. Painting of wood exposed to view, except items which are specified to be painted or finished under other Sections of these specifications. Back painting of all wood in contact with concrete, masonry or other moisture areas.
  9. Painting pipes, pipe coverings, conduit, ducts, insulation, hangers, supports and other mechanical and electrical items and equipment exposed to view.
  10. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers lighting fixtures, and the like, which are exposed to view through these items.
  11. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.
  12. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
  13. Painting of any surface not specifically mentioned to be painted herein or on construction documents, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, is to be included as though specified.

**1.2 RELATED WORK:**

- A. Activity Hazard Analysis: Section 01 35 26, SAFETY REQUIREMENTS.
- B. Masonry Repairs: Section 04 05 16, MASONRY GROUTING.
- .
- .

### **1.3 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Painter qualifications.
- C. Manufacturer's Literature and Data:
  - 1. Before work is started, or sample panels are prepared, submit manufacturer's literature and technical data, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one (1) list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.
- E. Sample Panels:
  - 1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.
  - 2. Panels to Show Color: Composition board, 100 x 250 mm (4 x 10 inch).
  - 3. Attach labels to panel stating the following:
    - a. Federal Specification Number or manufacturers name and product number of paints used.
    - b. Specification code number specified in Section 09 06 00, SCHEDULE FOR FINISHES.
    - c. Product type and color.
    - d. Name of project.
  - 4. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.
- F. Sample of identity markers if used.
- G. Manufacturers' Certificates indicating compliance with specified requirements:
  - 1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
  - 2. Epoxy coating.

### **1.4 DELIVERY AND STORAGE:**

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
  - 1. Name of manufacturer.
  - 2. Product type.
  - 3. Batch number.
  - 4. Instructions for use.
  - 5. Safety precautions.
- B. In addition to manufacturer's label, provide a label legibly printed as following:

1. Federal Specification Number, where applicable, and name of material.
2. Surface upon which material is to be applied.
3. Specify Coat Types: Prime; body; finish; etc.
- C. Maintain space for storage, and handling of painting materials and equipment in a ventilated, neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 7 and 30 degrees C (45 and 85 degrees F).

#### **1.5 QUALITY ASSURANCE:**

- A. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. Submit evidence that key personnel have successfully performed surface preparation and application of coating on a minimum of three (3) similar projects within the past three (3) years.
- B. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Contracting Officer Representative (COR) in writing of any anticipated problems using the coating systems as specified with substrates primed by others.

#### **1.6 REGULATORY REQUIREMENTS:**

- A. Paint materials are to conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
  1. Volatile Organic Compounds (VOC) Emissions Requirements: Field-applied paints and coatings that are inside the waterproofing system to not exceed limits of authorities having jurisdiction.
  2. Lead: Provide materials that do not contain lead.
  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 ACGIH-DOC confirmed or suspected human carcinogens.
  6. Use high performance acrylic paints in place of alkyd paints.

#### **1.8 SAFETY AND HEALTH**

- A. Apply paint materials using safety methods and equipment in accordance with the following:
  1. Comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis (AHA) as specified in Section 01 35 26, SAFETY REQUIREMENTS. The AHA is to include analyses of the potential impact of

painting operations on painting personnel and on others involved in and adjacent to the work zone.

B. Safety Methods Used During Paint Application: Comply with the requirements of SSPC PA Guide 10.

C. Toxic Materials: To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

1. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
2. 29 CFR 1910.1000.
3. ACHIH-BKLT and ACGHI-DOC, threshold limit values.

#### **1.9 APPLICABLE PUBLICATIONS:**

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

B. American Conference of Governmental Industrial Hygienists (ACGIH):

ACGIH TLV-BKLT-2012..... Threshold Limit Values (TLV) for Chemical Substances and  
Physical Agents and Biological Exposure Indices (BEIs)

ACGIH TLV-DOC-2012..... Documentation of Threshold Limit Values and Biological Exposure  
Indices, (Seventh Edition)

C. ASME International (ASME):

A13.1-07(R2013)..... Scheme for the Identification of Piping Systems

D. Code of Federal Regulation (CFR):

40 CFR 59..... Determination of Volatile Matter Content, Water Content, Density  
Volume Solids, and Weight Solids of Surface Coating

E. Commercial Item Description (CID):

A-A-1272A..... Plaster Gypsum (Spackling Compound)

F. Federal Specifications (Fed Spec):

TT-P-1411A..... Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete  
and Masonry Walls) (CEP)

G. Master Painters Institute (MPI):

4 ..... Interior/ Exterior Latex Block Filler

5 ..... Exterior Alkyd Wood Primer

8 ..... Exterior Alkyd, Flat MPI Gloss Level 1

10 ..... Exterior Latex, Flat

11 ..... Exterior Latex, Semi-Gloss

18 ..... Organic Zinc Rich Primer

44 ..... Interior Low Sheen Latex, MPI Gloss Level 2

45 ..... Interior Primer Sealer

47 ..... Interior Alkyd, Semi-Gloss, MPI Gloss Level 5

- 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
  
- 94 ..... Exterior Alkyd, Semi-Gloss
- 95 ..... Fast Drying Metal Primer
- 101 ..... Epoxy Anti-Corrosive Metal Primer
- 134 ..... Galvanized Water Based Primer
- 138 ..... Interior High Performance Latex, MPI Gloss Level 2
- 139 ..... Interior High Performance Latex, MPI Gloss Level 3

G. Society for Protective Coatings (SSPC):

- SSPC SP 1-82(R2004) ..... Solvent Cleaning
- SSPC SP 2-82(R2004) ..... Hand Tool Cleaning
- SSPC SP 3-28(R2004) ..... Power Tool Cleaning
- SSPC SP 10/NACE No.2 ..... Near-White Blast Cleaning
- SSPC PA Guide 10 ..... Guide to Safety and Health Requirements

H. Maple Flooring Manufacturer's Association (MFMA):

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

- 29 CFR 1910.1000 ..... Air Contaminants

J. Underwriter's Laboratory (UL)

## PART 2 - PRODUCTS

### 2.1 MATERIALS:

- A. Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents.

### 2.2 PAINT PROPERTIES:

- A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.
- B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.
- C. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only to recommended limits.

D. VOC Content: For field applications that are inside the weatherproofing system, paints and coating to comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Non-flat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoats: 200 g/L.
5. Anticorrosive and Antirust Paints applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Shellacs, Clear: 730 g/L.
9. Shellacs, Pigmented: 550 g/L.

E. VOC test method for paints and coatings is to be in accordance with 40 CFR 59 (EPA Method 24). Part 60, Appendix A with the exempt compounds' content determined by Method 303 (Determination of Exempt Compounds) in the South Coast Air Quality Management District's (SCAQMD) "Laboratory Methods of Analysis for Enforcement Samples" manual.

## **2.3 PLASTIC TAPE:**

- A. Pigmented vinyl plastic film in colors as specified.
- B. Pressure sensitive adhesive back.

## **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.

### **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, hinges, 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, door hardware and doors before painting walls. Paint separately and re-install after all paint is dry.
- F. Materials are to be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.
- G. Apply materials with a coverage to hide substrate completely. When color, stain, dirt or undercoats show through final coat of paint, the surface is to be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage, at no additional cost to the Government.
- H. All coats are to be dry to manufacturer's recommendations before applying succeeding coats.
- I. All suction spots or "hot spots" in plaster after the application of the first coat are to be touched up before applying the second coat.
- J. Do not apply paint behind frameless mirrors that use mastic for adhering to wall surface.



### **3.4 SURFACE PREPARATION:**

#### **A. General:**

1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished are to be completely dry, clean and smooth.
2. See other sections of specifications for specified surface conditions and prime coat.
3. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
4. Clean surfaces before applying paint or surface treatments with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.
5. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - a. Concrete: 12 percent.
  - b. Fiber-Cement Board: 12 percent.
  - c. Masonry (Clay and CMU's): 12 percent.
  - d. Wood: 15 percent.
  - e. Gypsum Board: 12 percent.
  - f. Plaster: 12 percent.

#### **B. Wood:**

1. Sand to a smooth even surface and then dust off.
2. Sand surfaces showing raised grain smooth between each coat.
3. Wipe surface with a tack rag prior to applying finish.
4. Surface painted with an opaque finish:
  - a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
  - b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.

- a. Thin filler in accordance with manufacturer's instructions for application.
  - b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.
- C. Ferrous Metals:
  1. Remove oil, grease, and soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
  2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning).
  3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
    - a. Fill flat head countersunk screws used for permanent anchors.
    - b. Do not fill screws of item intended for removal such as glazing beads.
  4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
  5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.
- D. Zinc-Coated (Galvanized) Metal, Surfaces to be painted:
  1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
  2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer).
- E. Masonry, Concrete, Cement Board, Cement Plaster and Stucco:
  1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
  2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
  3. Remove loose mortar in masonry work.
  4. Replace mortar and fill open joints, holes, cracks and depressions with new mortar specified in Section 04 05 16, MASONRY GROUTING . Do not fill weep holes. Finish to match adjacent surfaces.
  5. Neutralize Concrete floors to be painted by washing with a solution of 1.4 Kg (3 pounds) of zinc sulfate crystals to 3.8 L (1 gallon) of water, allow to dry three (3) days and brush thoroughly free of crystals.
  6. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces. Remove projections to level of adjacent surface by grinding or similar methods.

F. Gypsum Plaster and Gypsum Board:

1. Remove efflorescence, loose and chalking plaster or finishing materials.
2. Remove dust, dirt, and other deterrents to paint adhesion.
3. Fill holes, cracks, and other depressions with CID-A-A-1272A finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

**3.5 PAINT PREPARATION:**

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two (2) component and two (2) part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

**3.6 APPLICATION:**

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three (3) coats; prime, body, and finish. When two (2) coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.
- D. Allow not less than 48 hours between applications 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 is not allowed.
- F. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

**3.7 PRIME PAINTING:**

- A. After surface preparation, prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.
- D. Prime rabbets for stop and face glazing of wood, and for face glazing of steel.

E. Wood

1. Use same kind of primer specified for exposed face surface.
  - a. Exterior wood: MPI 5(Exterior Alkyd Wood Primer) for repainting bare wood primer except where MPI 90 (Interior Wood Stain, Semi-Transparent) is scheduled.
  - b. Interior wood except for transparent finish: MPI 45 (Interior Primer Sealer), thinned if recommended by manufacturer.
2. Apply two (2) coats of primer MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) to surfaces of wood doors, including top and bottom edges, which are cut for fitting or for other reason.
3. Apply one (1) coat MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) as soon as delivered to site to surfaces of unfinished woodwork, except concealed surfaces of shop fabricated or assembled millwork and surfaces specified to have varnish, stain or natural finish.
4. Back prime and seal ends of exterior woodwork, and edges of exterior plywood specified to be finished.

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

1. Steel and iron: MPI 95 (Fast Drying Metal Primer) where refinish is required to match existing conditions.
2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer).
3. Aluminum scheduled to be painted: MPI 95 (Fast Drying Metal Primer).

G. Gypsum Board:

1. Surfaces where refinish is required to match existing conditions or new surface are required to be finished per this specification: MPI 10 (Exterior Latex, Flat), MPI 11 (Exterior Latex, Semi-Gloss), MPI 53 (Interior Latex, Flat), MPI Gloss Level 1 MPI 52 (Interior Latex, MPI Gloss Level 3) respectively .
2. Primer: MPI 50 (Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer) in shower and bathrooms.

I. Concrete Masonry Units except glazed or integrally colored and decorative units:

1. MPI 4 (Block Filler) on interior surfaces.

J. Concrete Masonry, Interior Surfaces of Ceilings and Walls:

1. MPI 53 (Interior Latex, Flat, MPI Gloss Level 1), MPI 52 (Interior Latex, MPI Gloss Level 3) except use two (2) coats where substrate has aged less than six (6) months to match existing conditions.

**3.8 EXTERIOR FINISHES:**

- A. Apply following finish coats where refinish is required to match existing conditions or new surface are required to be finished per this specification:

B. Wood:

1. Do not apply finish coats on surfaces concealed after installation, top and bottom edges of wood doors and sash, or on edges of wood framed insect screens.
2. Two (2) coats of MPI 10 Exterior Latex, Flat), MPI 11 (Exterior Latex, Semi-Gloss) on exposed surfaces, except where transparent finish is specified.

C. Steel and Ferrous Metal:

1. Two (2) coats of MPI 8 (Exterior Alkyd, Flat) on exposed surfaces, except on surfaces over 94 degrees C (201 degrees F).

D. Concrete Masonry Units:

1. General:
  - a. where refinish is required to match existing conditions or new surface are required to be finished per this specification.
  - b. Mix as specified in manufacturer's printed directions.
  - c. Do not mix more paint than can be used within four (4) hours after mixing. Discard paint that has started to set.
  - d. Dampen warm surfaces above 24 degrees C (75 degrees F) with fine mist of water before application of paint. Do not leave free water on surface.
  - e. Cure paint with a fine mist of water as specified in manufacturer's printed instructions.
2. Use two (2) coats of TT-P-1411 (Paint, Co-polymer-Resin, Cementitious), unless specified otherwise.

**3.9 INTERIOR FINISHES:**

A. Apply where refinish is required to match existing conditions or new surface are required to be finished per this specification:

B. Metal Work:

1. Apply to exposed surfaces.
2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
  - a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) unless specified otherwise.

C. Gypsum Board:

1. One (1) coat of MPI 45 (Interior Primer Sealer) plus one (1) coat of MPI 139 (Interior High Performance Latex, MPI Gloss level 3).
2. Two (2) coats of MPI 138 (Interior High Performance Latex, MPI Gloss Level 2).

E. Masonry and Concrete Walls:

1. Over MPI 4 (Interior/Exterior Latex Block Filler) on CMU surfaces.
2. Two (2) coats of MPI 53 (Interior Latex, Flat, MPI Gloss Level 1, MPI 52 (Interior Latex, MPI Gloss Level 3).

F. Wood:

1. Sanding:

- a. Use 220-grit sandpaper.
- b. Sand sealers and varnish between coats.
- c. Sand enough to scarify surface to assure good adhesion of subsequent coats, to level roughly applied sealer and varnish, and to knock off "whiskers" of any raised grain as well as dust particles.

2. Sealers:

- b. Apply sealers as required to obtain manufacturer's finish except sealer may be omitted where pigmented, penetrating, or wiping stains containing resins are used.
- c. Allow manufacturer's recommended drying time before sanding, but not less than 24 hours or 36 hours in damp or muggy weather.
- d. Sand as specified.

3. Paint Finish:

- a. One (1) coat of MPI 45 (Interior Primer Sealer)
- b. Two (2) coats of MPI 51 (Interior Alkyd, Eggshell).

I. Miscellaneous:

- 1. Apply where specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- 2. Existing acoustical units scheduled to be repainted except acoustical units with a vinyl finish:
  - a. Clean units free of dust, dirt, grease, and other deterrents to paint adhesion.
  - b. Mineral fiber units: One (1) coat of MPI 53 (Interior Latex, Flat, MPI Gloss Level 1).

**3.10 REFINISHING EXISTING PAINTED SURFACES:**

- A. Clean, patch and repair existing surfaces as specified under "Surface Preparation". No "telegraphing" of lines, ridges, flakes, etc., through new surfacing is permitted. Where this occurs, sand smooth and re-finish until surface meets with COR's approval.
- B. Remove and reinstall items as specified under "General Workmanship Requirements".
- C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.
- D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.
- E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
- F. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- G. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.
- H. Sand or dull glossy surfaces prior to painting.

- I. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

### **3.11 PAINT COLOR:**

- A. Color and gloss of finish coats is to match all existing conditions. If a color is not existing please notify the COR that a color selection is required.
- B. For additional requirements regarding color see Articles, "REFINISHING EXISTING PAINTED SURFACE" and "MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE".
- C. Coat Colors:
  1. Color of priming coat: Lighter than body coat.
  2. Color of body coat: Lighter than finish coat.
  3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.
- D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
  1. Paint to match color of casework where casework has a paint finish.
  2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

### **3.12 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE:**

- A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.
- B. In spaces not scheduled to be finish painted, paint as specified below.
- C. Paint various systems specified in Division 02 – EXISTING CONDITIONS, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 – ELECTRONIC SAFETY AND SECURITY.
- D. Paint after tests have been completed.
- E. Omit prime coat from factory prime-coated items.
- F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.
- G. Omit field painting of items specified in "BUILDING AND STRUCTURAL WORK FIELD PAINTING"; "Building and Structural Work not Painted".
- H. Color:
  1. Paint items having no color specified, paint to match surrounding surfaces.
  2. Paint colors as specified except for following:

- a. White: Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
  - b. Gray: Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
  - c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
  - d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
  - e. Federal Safety Orange: Entire lengths of electrical conduits containing feeders 600 volts or more.
  - f. Color to match brickwork sheet metal covering on breeching outside of exterior wall of boiler house.
- I. Apply paint systems on properly prepared and primed surface as follows:
- 1. Exterior Locations:
    - a. Apply two (2) coats of MPI 94 (Exterior Alkyd, Semi-gloss) to the following ferrous metal items:  
Vent and exhaust pipes with temperatures under 94 degrees C (201 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.
    - b. Apply two (2) coats of MPI 10 (Exterior Latex, Flat) to galvanized and zinc-copper alloy metal.
    - c. Apply one (1) coat of MPI 22 (High Heat Resistant Coating), 650 degrees C (1200 degrees F) to incinerator stacks, boiler stacks, and engine generator exhaust.
  - 2. Interior Locations:
    - a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) to following items:
      - 1) Metal under 94 degrees C (201 degrees F) of items such as bare piping, fittings, hangers and supports.
      - 2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.
      - 3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.
    - b. Paint electrical conduits containing cables rated 600 volts or more using two (2) coats of MPI 94 (Exterior Alkyd, Semi-gloss) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.



### **3.13 BUILDING AND STRUCTURAL WORK FIELD PAINTING:**

- A. Painting and finishing of interior and exterior work except as specified here-in-after.
  - 1. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
  - 3. Painting of ferrous metal and galvanized metal.
  - 4. Painting of wood with fire retardant paint exposed in attics, when used as mechanical equipment space (except shingles).
  - 5. Identity painting and safety painting.
  - 6. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundations walls and interior walls in pipe basements.
  - 7. Face brick.
  - 8. Structural steel encased in concrete, masonry, or other enclosure.
  - 9. Structural steel to receive sprayed-on fire proofing.
  - 10. Ceilings, walls, columns in interstitial spaces.
  - 11. Ceilings, walls, and columns in pipe basements.
  - 12. Wood Shingles.

### **3.14 IDENTITY PAINTING SCHEDULE:**

- A. Identify designated service in new buildings or projects with extensive remodeling in accordance with ASME A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels. For existing spaces where work is minor match existing.
  - 1. Legend may be identified using snap-on coil plastic markers or by paint stencil applications.
  - 2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 12.2 M (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
  - 3. Locate Legends clearly visible from operating position.
  - 4. Use arrow to indicate direction of flow using black stencil paint.
  - 5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on construction documents where asterisk appears for High, Medium, and Low Pressure designations as follows:
    - a. High Pressure - 414 kPa (60 psig) and above.
    - b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
    - c. Low Pressure - 103 kPa (14 psig) and below.
    - d. Add Fuel oil grade numbers.

6. Electrical Conduits containing feeders over 600 volts, paint legends using 50 mm (2 inch) high black numbers and letters, showing the voltage class rating. Provide legends where conduits pass through walls and floors and at maximum 6096 mm (20 foot) intervals in between. Use labels with yellow background with black border and words Danger High Voltage Class, 5000, 15000, and 25000.
  7. See Sections for methods of identification, legends, and abbreviations of the following:
    - a. Conduits containing high voltage feeders over 600 volts: Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS / Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS
- B. Fire and Smoke Partitions:
1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
  2. Stenciled message: "SMOKE BARRIER" or "FIRE BARRIER" as applicable.
  3. Locate not more than 6096 mm (20 feet) on center on corridor sides of partitions, and with a least one (1) message per room on room side of partition.
  4. Use semi-gloss paint of color that contrasts with color of substrate.
- C. Identify columns in pipe basements and interstitial space:
1. Apply stenciled number and letters to correspond with grid numbering and lettering indicated on construction documents.
  2. Paint numbers and letters 101 mm (4 inches) high, locate 45 mm (18 inches) below overhead structural slab.
  3. Apply on four (4) sides of interior columns and on inside face only of exterior wall columns.
  4. Color:
    - a. Use black on concrete columns.
    - b. Use white or contrasting color on steel columns.

### **3.15 PROTECTION CLEAN UP, AND TOUCH-UP:**

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

--- E N D ---

**SECTION 13 05 41**  
**SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS**

**PART 1 – GENERAL**

**1.1 DESCRIPTION:**

- A. Provide seismic restraint in accordance with the requirements of this section in order to maintain the integrity of nonstructural components of the building so that they remain safe and functional in case of seismic event and match all existing conditions.
- B. The design to resist seismic load shall be based on Seismic Design Categories per section 4.0 of the VA Seismic Design Requirements (H-18-8) dated August 2013,  
<http://www.cfm.va.gov/till/etc/seismic.pdf>.
- C. Definitions: Non-structural building components are components or systems that are not part of the building's structural system whether inside or outside, above or below grade. Non-structural components of buildings include:
  - 1. Architectural Elements: Facades that are not part of the structural system and its shear resistant elements; cornices and other architectural projections and parapets that do not function structurally; glazing; nonbearing partitions; suspended ceilings; stairs isolated from the basic structure; cabinets; bookshelves; medical equipment; and storage racks.
  - 2. Electrical Elements: Power and lighting systems; substations; switchgear and switchboards; auxiliary engine-generator sets; transfer switches; motor control centers; motor generators; selector and controller panels; fire protection and alarm systems; special life support systems; and telephone and communication systems.
  - 3. Mechanical Elements: Heating, ventilating, and air-conditioning systems; medical gas systems; plumbing systems; sprinkler systems; pneumatic systems; boiler equipment and components.
  - 4. Transportation Elements: Mechanical, electrical and structural elements for transport systems, i.e., elevators and dumbwaiters, including hoisting equipment and counterweights.

**1.2 RELATED WORK:**

- A. Section 09 51 00: ACOUSTICAL CEILINGS.
- B. Section 26 05 11: REQUIREMENTS FOR ELECTRICAL INSTALLATION
- C. Section 27 05 11: REQUIREMENTS FOR COMMUNICATION INSTALLATION

**1.3 QUALITY CONTROL:**

- A. Shop-Drawing Preparation:
  - 1. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer retained by the General Contractor experienced in the area of seismic force restraints. The professional structural engineer shall be registered in the state of Ohio.

2. Submit design tables and information used for the design-force levels, stamped and signed by a professional structural engineer registered in the State of Ohio.

B. Coordination:

1. Do not install seismic restraints until seismic restraint submittals are approved by the COR.
2. Coordinate and install trapezes or other multi-pipe hanger systems prior to pipe installation.

C. Seismic Certification:

In structures assigned to IBC Seismic Design Category C, D, E, or F, permanent equipment and components are to have Special Seismic Certification in accordance with requirements of section 13.2.2 of ASCE 7 except for equipment that are considered rugged as listed in section 2.2 OSHPD code application notice CAN No. 2-1708A.5, and shall comply with section 13.2.6 of ASCE 7.

**1.4 SUBMITTALS:**

A. Submit a coordinated set of equipment anchorage drawings prior to installation including:

1. Description, layout, and location of items to be anchored or braced with anchorage or brace points noted and dimensioned.
2. Details of anchorage or bracing at large scale with all members, parts brackets shown, together with all connections, bolts, welds etc. clearly identified and specified.
3. Numerical value of design seismic brace loads.
4. For expansion bolts, include design load and capacity if different from those specified.

B. Submit prior to installation, a coordinated set of bracing drawings for seismic protection of piping, with data identifying the various support-to-structure connections and seismic bracing structural connections, include:

1. Single-line piping diagrams on a floor-by-floor basis. Show all suspended piping for a given floor on the same plan.
2. Type of pipe (Copper, steel, cast iron, insulated, non-insulated, etc.).
3. Pipe contents.
4. Structural framing.
5. Location of all gravity load pipe supports and spacing requirements.
6. Numerical value of gravity load reactions.
7. Location of all seismic bracing.
8. Numerical value of applied seismic brace loads.
9. Type of connection (Vertical support, vertical support with seismic brace etc.).
10. Seismic brace reaction type (tension or compression): Details illustrating all support and bracing components, methods of connections, and specific anchors to be used.

C. Submit prior to installation, bracing drawings for seismic protection of suspended ductwork and suspended electrical and communication cables, include:

1. Details illustrating all support and bracing components, methods of connection, and specific anchors to be used.
  2. Numerical value of applied gravity and seismic loads and seismic loads acting on support and bracing components.
  3. Maximum spacing of hangers and bracing.
  4. Seal of registered structural engineer responsible for design.
- D. Submit design calculations prepared and sealed by the registered structural engineer specified above in paragraph 1.3A.
- E. Submit for concrete anchors, the appropriate ICBC evaluation reports, OSHPD pre-approvals, or lab test reports verifying compliance with OSHPD Interpretation of Regulations 28-6.

#### **1.5 APPLICABLE PUBLICATIONS:**

- A. The Publications listed below (including amendments, addenda revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
- 355.2-07 .....Qualification for Post-Installed Mechanical Anchors in Concrete  
and Commentary
- C. American Institute of Steel Construction (AISC):
- Load and Resistance Factor Design, Volume 1, Second Edition
- D. American Society for Testing and Materials (ASTM):
- A36/A36M-08 .....Standard Specification for Carbon Structural Steel
- A53/A53M-10 .....Standard Specification for Pipe, Steel, Black and Hot-Dipped,  
Zinc-Coated, Welded and Seamless
- A307-10.....Standard Specification for Carbon Steel Bolts and Studs; 60,000  
PSI Tensile Strength.
- A325-10.....Standard Specification for Structural Bolts, Steel, Heat Treated,  
120/105 ksi Minimum Tensile Strength
- A325M-09.....Standard Specification for High-Strength Bolts for Structural  
Steel Joints [Metric]
- A490-10.....Standard Specification for Heat-Treated Steel Structural Bolts,  
150 ksi Minimum Tensile Strength
- A490M-10.....Standard Specification for High-Strength Steel Bolts, Classes  
10.9 and 10.9.3, for Structural Steel Joints [Metric]
- A500/A500M-10 .....Standard Specification for Cold-Formed Welded and Seamless  
Carbon Steel Structural Tubing in Rounds and Shapes
- A501-07 .....Specification for Hot-Formed Welded and Seamless Carbon  
Steel Structural Tubing

- A615/A615M-09 ..... Standard Specification for Deformed and Plain Billet-Steel Bars  
for Concrete Reinforcement
- A992/A992M-06 ..... Standard Specification for Steel for Structural Shapes for Use in  
Building Framing
- A996/A996M-09 ..... Standard Specification for Rail-Steel and Axel-Steel Deformed  
Bars for Concrete Reinforcement
- E488-96(R2003)..... Standard Test Method for Strength of Anchors in Concrete and  
Masonry Element
- E. American Society of Civil Engineers (ASCE 7) Latest Edition.
- F. International Building Code (IBC) Latest Edition
- G. VA Seismic Design Requirements, H-18-8, August 2013
- H. National Uniform Seismic Installation Guidelines (NUSIG)
- I. Sheet Metal and Air Conditioning Contractors National Association  
(SMACNA): Seismic Restraint Manual - Guidelines for Mechanical Systems, 2012 Edition and  
Addendum

#### **1.6 REGULATORY REQUIREMENT:**

- A. IBC Latest Edition.
- B. Exceptions: The seismic restraint of the following items may be omitted:
  - 1. Equipment weighing less than 400 pounds, which is supported directly on the floor or roof.
  - 2. Equipment weighing less than 20 pounds, which is suspended from the roof or floor or hung  
from a wall.
  - 3. Gas and medical piping less than 2 ½ inches inside diameter.
  - 4. Piping in boiler plants and equipment rooms less than 1 ¼ inches inside diameter.
  - 5. All other piping less than 2 ½ inches inside diameter, except for automatic fire suppression  
systems.
  - 6. All piping suspended by individual hangers, 12 inches or less in length from the top of pipe to  
the bottom of the support for the hanger.
  - 7. All electrical conduits, less than 2 ½ inches inside diameter.
  - 8. All rectangular air handling ducts less than six square feet in cross sectional area.
  - 9. All round air handling ducts less than 28 inches in diameter.
  - 10. All ducts suspended by hangers 12 inches or less in length from the top of the duct to the  
bottom of support for the hanger.

## **PART 2 – PRODUCTS**

### **2.1 STEEL:**

- A. Structural Steel: ASTM A36.

- B. Structural Tubing: ASTM A500, Grade B.
- C. Structural Tubing: ASTM A501.
- D. Steel Pipe: ASTM A53/A53M, Grade B.
- E. Bolts & Nuts: ASTM A307, A325, and A490.

## **2.2 CAST-IN-PLACE CONCRETE:**

- A. Concrete: 28 day strength,  $f'_c = 30$  MPa (4,000 psi)
- B. Reinforcing Steel: ASTM A615/615M or ASTM A996/A996M deformed.

## **PART 3 – EXECUTION**

### **3.1 CONSTRUCTION, GENERAL:**

- A. Provide equipment supports and anchoring devices to withstand the seismic design forces, so that when seismic design forces are applied, the equipment cannot displace, overturn, or become inoperable.
- B. Provide anchorages in conformance with recommendations of the equipment manufacturer and as shown on approved shop drawings and calculations.
- C. Construct seismic restraints and anchorage to allow for thermal expansion.
- D. Testing Before Final Inspection:
  - 1. Test 10-percent of anchors in masonry and concrete per ASTM E488, and ACI 355.2 to determine that they meet the required load capacity. If any anchor fails to meet the required load, test the next 20 consecutive anchors, which are required to have zero failure, before resuming the 10-percent testing frequency.
  - 2. Before scheduling Final Inspection, submit a report on this testing indicating the number and location of testing, and what anchor-loads were obtained.

### **3.2 EQUIPMENT RESTRAINT AND BRACING:**

- A. All equipment identified by the Contractor not meeting the exceptions of 1.6B is to be restrained or braced.

### **3.3 MECHANICAL DUCTWORK AND PIPING; BOILER PLANT STACKS AND BREACHING; ELECTRICAL BUSWAYS, CONDUITS, AND CABLE TRAYS; AND TELECOMMUNICATION WIRES AND CABLE TRAYS**

- A. Support and brace mechanical ductwork and piping; electrical busways, conduits and cable trays; and telecommunication wires and cable trays including boiler plant stacks and breeching to resist directional forces (lateral, longitudinal and vertical).
- B. Brace duct and breeching branches with a minimum of 1 brace per branch.
- C. Provide supports and anchoring so that, upon application of seismic forces, piping remains fully connected as operable systems which will not displace sufficiently to damage adjacent or connecting equipment, or building members.

D. Seismic Restraint of Piping:

1. Design criteria:

- a. Piping resiliently supported: Restrain to support 120-percent of the weight of the systems and components and contents.
- b. Piping not resiliently supported: Restrain to support 60-percent of the weight of the system components and contents.

2. Provide seismic restraints according to one of the following options:

- E. Piping Connections: Provide flexible connections where pipes connect to equipment. Make the connections capable of accommodating relative differential movements between the pipe and equipment under conditions of earthquake shaking.

**3.4 PARTITIONS**

- A. In buildings with flexible structural frames, anchor partitions to only structural element, such as a floor slab, and separate such partition by a physical gap from all other structural elements.
- B. Properly anchor masonry walls to the structure for restraint, so as to carry lateral loads imposed due to earthquake along with their own weight and other lateral forces.

**3.5 CEILINGS AND LIGHTING FIXTURES**

- A. At regular intervals, laterally brace suspended ceilings against lateral and vertical movements, and provide with a physical separation at the walls.

**3.7 STORAGE RACKS, CABINETS, AND BOOKCASES**

- A. Install storage racks to withstand earthquake forces and anchored to the floor or laterally braced from the top to the structural elements.
- B. Anchor all supply cabinets to the floor or walls and equip them with properly engaged, lockable latches.
- C. Anchor filing cabinets that are more than 2 drawers high to the floor or walls, and equip all drawers with properly engaged, lockable latches.
- D. Anchor bookcases that are more than 30 inches high to the floor or walls, and equip any doors with properly engaged, lockable latches.

--- 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 and cable, panelboards, and other items and arrangements for the specified items are shown on the drawings.
- C. Conductor ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited.

**1.2 MINIMUM REQUIREMENTS**

- A. The International Building Code (IBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.
- B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

**1.3 TEST STANDARDS**

- A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.
- B. Definitions:
  - 1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed materials and

- equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
  3. Certified: Materials and equipment which:
    - a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
    - b. Are periodically inspected by a NRTL.
    - c. Bear a label, tag, or other record of certification.
  4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

#### **1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)**

- A. Manufacturer's Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.
- B. Product Qualification:
  1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.
  2. The Government reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.
- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

**1.5 APPLICABLE PUBLICATIONS**

- A. Applicable publications listed in all Sections of Division 26 are the latest issue, unless otherwise noted.
- B. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

**1.6 MANUFACTURED PRODUCTS**

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available.
- 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 Testing Is Specified:
  - 1. When materials and equipment fail factory tests, and re-testing and re-inspection is required, the Contractor shall be liable for all additional expenses for the Government to witness re-testing.

**1.7 VARIATIONS FROM CONTRACT REQUIREMENTS**

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

**1.8 MATERIALS AND EQUIPMENT PROTECTION**

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

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

#### **1.9 WORK PERFORMANCE**

- A. All electrical work shall comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J - General Environmental Controls, OSHA Part 1910 subpart K - Medical and First Aid, and OSHA Part 1910 subpart S - Electrical, in addition to other references required by contract.
- B. Job site safety and worker safety is the responsibility of the Contractor.
- C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:
  1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
  2. Before initiating any work, a job specific work plan must be developed by the Contractor with a peer review conducted and documented by the COR and Medical Center staff. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used, and exit pathways.
  3. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the COR.

- D. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.
- E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.
- F. Coordinate location of equipment and conduit with other trades to minimize interference.

#### **1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS**

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Working clearances shall not be less than specified in the NEC.
- C. Inaccessible Equipment:
  - 1. Where the Government determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
  - 2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

#### **1.11 EQUIPMENT IDENTIFICATION**

- A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches, 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 NFPA 70E. Label shall indicate the arc hazard boundary (inches), working distance (inches), arc flash incident energy at the working distance (calories/cm<sup>2</sup>), required PPE category and description including the glove rating, voltage rating of the equipment, limited approach distance (inches), restricted approach distance (inches), prohibited approach distance (inches), equipment/bus name, date prepared, and manufacturer name and address.

#### **1.12 SUBMITTALS**

- A. Submit to the COR in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. The Government's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.
- C. All submittals shall include six copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Government to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.
- D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
1. Mark the submittals, "SUBMITTED UNDER SECTION\_\_\_\_\_".
  2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
  3. Submit each section separately.
- E. The submittals shall include the following:
1. Information that confirms compliance with contract requirements.  
Include the manufacturer's name, model or catalog numbers, catalog

- information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.
2. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
  3. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.
- F. Maintenance and Operation Manuals:
1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
  2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.
  3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
  4. The manuals shall include:
    - a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
    - b. A control sequence describing start-up, operation, and shutdown.
    - c. Description of the function of each principal item of equipment.
    - d. Installation instructions.
    - e. Safety precautions for operation and maintenance.
    - f. Diagrams and illustrations.
    - g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
    - h. Performance data.
    - i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.

- j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.
- G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.
- H. After approval and prior to installation, furnish the COR with one sample of each of the following:
  - 1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
  - 2. Each type of conduit coupling, bushing, and termination fitting.
  - 3. Conduit hangers, clamps, and supports.
  - 4. Duct sealing compound.
  - 5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

#### **1.13 SINGULAR NUMBER**

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

#### **1.14 ACCEPTANCE CHECKS AND TESTS**

- A. The Contractor shall furnish the instruments, materials, and labor for tests.
- B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer's representatives and technicians so that a complete, functional, and operational system is delivered to the Government.
- C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests. Repair, replacement, and retesting shall be accomplished at no additional cost to the Government.



**1.15 WARRANTY**

- A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer for the Government.

**1.16 INSTRUCTION**

- A. Instruction to designated Government personnel shall be provided for the particular equipment or system as required in each associated technical specification section.
- B. Furnish the services of competent instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be trained in operating theory as well as practical operation and maintenance procedures.
- 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.

**1.17 DRAWINGS AND SPECIFICATIONS**

- A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word "provide", as used, shall mean "furnish and install". If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the COR for approval before proceeding with the work.
- B. Make all necessary field measurements to ensure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.
- C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the COR for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Having bus duct, wireways and fittings fabricated and delivered in advance of making actual measurements shall not be sufficient cause to avoid making offsets and minor changes as may be necessary to install bus duct, wireways, fittings and equipment.

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- D. The COR shall reserve the right to make minor adjustment in locations of system runs and components where he considers such adjustments desirable in the interest of protecting and concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.
- E. Equipment, ductwork and piping shall not be installed in the dedicated electrical space above or in the working space required around electrical switchgear, motor control centers or panelboards as identified by NEC 110.26 Spaces About Electrical Equipment - 600 Volts Nominal or Less. For equipment rated over 600 volts nominal - 110.32 Work Space About Equipment - 110.33 Entrance and Access to Work Space - 110.34 Work Space and Guarding. The Electrical Contractor shall caution other trades to comply with this stipulation.
- F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the contractor causing such conflict. The COR's decision shall be final in regard to the arrangement of bus duct, conduit, etc., where conflict arises.
- G. Provide offsets in system runs, additional fittings, necessary conduit, pull boxes, conductors, switches and devices required to complete the installation, or for the proper operation of the system. Each Contractor shall exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.
- H. Should overlap of work among the trades become evident, this shall be called to the attention of the COR. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the COR.

**1.18 RECORD DRAWINGS**

- A. The Electrical Contractor shall maintain a separate set of prints of the contract documents and shall show all changes or variations, in a manner to be clearly discernible, which are made during construction. Upon completion of the work, these drawings shall be turned over to the Architect. This shall apply particularly to underground and concealed

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work, and to other systems where the installation varies to a degree which would justify recording the change.

#### 1.19 FINAL INSPECTION AND PUNCH LIST

- A. As the time of work completion approaches, the Contractor shall survey and inspect his work and develop his own punch list to confirm that it is complete and finished. He shall then notify the COR and request that a final inspection be made. It shall not be considered the COR's obligation to perform a final inspection until the Contractor has inspected the work and so states at the time of the request for the final inspection.
- B. Requests to the COR for final inspection may be accompanied by a limited list of known deficiencies in completion, with appropriate explanation and schedule for completing these; this is in the interest of expediting acceptance for beneficial occupancy.
- C. The Architect and/or Engineer will inspect the work and prepare a punch list of items requiring correction, completion or verification. Corrective action shall be taken by the Contractor to the satisfaction of Architect and Engineer within 30 days of receipt of the Architect/Engineer's punch list.

#### 1.20 REMOVALS

- A. Remove ALL existing work which will be superfluous when the new system is installed and made operational. Not all items that need to be removed are necessarily shown on the drawings. Void unused conduit behind walls or below floors as necessary or as directed. No wire or conduit shall be removed which will impair the functioning of the remaining work unless first replaced with a rerouted section of wire or conduit to ensure continuity. Remove inactive wiring back to the last active junction box, panelboard or piece of equipment.
- B. Upon completion, no unused conduit or stub shall extend thru floors, walls or ceilings in finished areas. Abandoned conduit where remaining in place shall have any unused wiring removed. All accessible unused conduit shall be removed.
- C. When it is necessary to reroute a section of an active circuit, the rerouted section shall be installed before removing the existing in order to minimize system down time. Rerouted sections shall be installed as required for new work.

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D. Division 26 contractor shall be responsible for removing all existing backboxes not maintained for new work. Patch and repair all existing drywall associated with removal work to match existing conditions.

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

**PART 3 - EXECUTION (NOT USED)**

---END---

**SECTION 26 05 19**  
**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of the electrical conductors and cables for use in electrical systems rated 600 V and below, indicated as cable(s), conductor(s), wire, or wiring in this section.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:  
Requirements that apply to all sections of Division 26.
- B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:  
Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for conductors and cables.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 FACTORY TESTS**

- A. Conductors and cables shall be thoroughly tested at the factory per NEMA to ensure that there are no electrical defects. Factory tests shall be certified.

**1.5 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Submit the following data for approval:
      - 1) Electrical ratings and insulation type for each conductor and cable.
      - 2) Splicing materials and pulling lubricant.
  2. Certifications: Two weeks prior to final inspection, submit the following.
    - a. Certification by the manufacturer that the conductors and cables conform to the requirements of the drawings and specifications.

- b. Certification by the Contractor that the conductors and cables have been properly installed, adjusted, and tested.

#### 1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.
- B. American Society of Testing Material (ASTM):
- D2301-10.....Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape
  - D2304-10.....Test Method for Thermal Endurance of Rigid Electrical Insulating Materials
  - D3005-10.....Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape
- C. National Electrical Manufacturers Association (NEMA):
- WC 70-09.....Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy
- D. National Fire Protection Association (NFPA):
- 70-14.....National Electrical Code (NEC)
- E. Underwriters Laboratories, Inc. (UL):
- 44-10.....Thermoset-Insulated Wires and Cables
  - 83-08.....Thermoplastic-Insulated Wires and Cables
  - 467-07.....Grounding and Bonding Equipment
  - 486A-486B-03.....Wire Connectors
  - 486C-04.....Splicing Wire Connectors
  - 486D-05.....Sealed Wire Connector Systems
  - 486E-09.....Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
  - 493-07.....Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables
  - 514B-04.....Conduit, Tubing, and Cable Fittings

#### PART 2 - PRODUCTS

##### 2.1 CONDUCTORS AND CABLES

- A. Conductors and cables shall be in accordance with NEMA, UL, as specified herein, and as shown on the drawings.
- B. All conductors shall be copper.
- C. Single Conductor and Cable:

1. No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.
2. No. 12 AWG and larger: Stranded.
3. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

E. Color Code:

1. No. 10 AWG and smaller: Solid color insulation or solid color coating.
2. No. 8 AWG and larger: Color-coded using one of the following methods:
  - a. Solid color insulation or solid color coating.
  - b. Stripes, bands, or hash marks of color specified.
  - c. Color using 19 mm (0.75 inches) wide tape.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
5. Conductors shall be color-coded as follows:

208/120 V	Phase	480/277 V
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

6. Lighting circuit "switch legs", and 3-way and 4-way switch "traveling wires," shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Coordinate color coding in the field with the COR.
7. Color code for isolated power system wiring shall be in accordance with the NEC.

## 2.2 SPLICES

- A. Splices shall be in accordance with NEC and UL.
- B. Above Ground Splices for No. 10 AWG and Smaller:
  1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.
  2. The integral insulator shall have a skirt to completely cover the stripped conductors.

3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.
- C. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:
1. Compression, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
  2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
  3. Splice and insulation shall be product of the same manufacturer.
  4. All bolts, nuts, and washers used with splices shall be cadmium-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.
- G. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

### **2.3 CONNECTORS AND TERMINATIONS**

- A. Mechanical type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
- B. Long barrel compression type of high conductivity and corrosion-resistant material, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
- C. All bolts, nuts, and washers used to connect connections and terminations to bus bars or other termination points shall be cadmium-plated steel.

### **2.4 CONTROL WIRING**

- A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG.
- B. Control wiring shall be sized such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.



**2.5 WIRE LUBRICATING COMPOUND**

- A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.
- B. Shall not be used on conductors for isolated power systems.

**PART 3 - EXECUTION****3.1 GENERAL**

- A. Install conductors in accordance with the NEC, as specified, and as shown on the drawings.
- B. Install all conductors in raceway systems.
- C. Splice conductors only in outlet boxes, junction boxes, pullboxes, manholes, or handholes.
- D. Conductors of different systems (e.g., 120 V and 277 V) shall not be installed in the same raceway.
- E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.
- F. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic ties.
- G. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.
- H. Use expanding foam or non-hardening duct-seal to seal conduits entering a building, after installation of conductors.
- I. Conductor and Cable Pulling:
  - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
  - 2. Use nonmetallic pull ropes.
  - 3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.
  - 4. All conductors in a single conduit shall be pulled simultaneously.
  - 5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- J. No more than three branch circuits shall be installed in any one conduit.
- K. When stripping stranded conductors, use a tool that does not damage the conductor or remove conductor strands.

**3.2 SPLICE AND TERMINATION INSTALLATION**

- A. Splices and terminations shall be mechanically and electrically secure, and tightened to manufacturer's published torque values using a torque screwdriver or wrench.
- B. Where the Government determines that unsatisfactory splices or terminations have been installed, replace the splices or terminations at no additional cost to the Government.

**3.3 CONDUCTOR IDENTIFICATION**

- A. When using colored tape to identify phase, neutral, and ground conductors larger than No. 8 AWG, apply tape in half-overlapping turns for a minimum of 75 mm (3 inches) from terminal points, and in junction boxes, pullboxes, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.

**3.4 FEEDER CONDUCTOR IDENTIFICATION**

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

**3.5 EXISTING CONDUCTORS**

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

**3.6 CONTROL WIRING INSTALLATION**

- A. Unless otherwise specified in other sections, install control wiring and connect to equipment to perform the required functions as specified or as shown on the drawings.
- B. Install a separate power supply circuit for each system, except where otherwise shown on the drawings.

**3.7 CONTROL WIRING IDENTIFICATION**

- A. Install a permanent wire marker on each wire at each termination.
- B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
- C. Wire markers shall retain their markings after cleaning.
- D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

**3.8 ACCEPTANCE CHECKS AND TESTS**

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:

1. Visual Inspection and Tests: Inspect physical condition.
2. Electrical tests:
  - a. After installation but before connection to utilization devices, such as fixtures, motors, or appliances, test conductors phase-to-phase and phase-to-ground resistance with an insulation resistance tester. Existing conductors to be reused shall also be tested.
  - b. Applied voltage shall be 500 V DC for 300 V rated cable, and 1000 V DC for 600 V rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300 V rated cable and 100 megohms for 600 V rated cable.
  - c. Perform phase rotation test on all three-phase circuits.

---END---

**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.
- B. "Grounding electrode system" refers to grounding electrode conductors and all electrodes required or allowed by NEC, as well as made, supplementary, and lightning protection system grounding electrodes.
- C. The terms "connect" and "bond" are used interchangeably in this section and have the same meaning.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:  
Requirements that apply to all sections of Division 26.
- B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES:  
Low-voltage conductors.
- C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
  - 1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Submit plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.
  - 2. Test Reports:
    - a. Two weeks prior to the final inspection, submit ground resistance field test reports to the COR.
  - 3. Certifications:
    - a. Certification by the Contractor that the grounding equipment has been properly installed and tested.

**1.5 APPLICABLE PUBLICATIONS**

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American Society for Testing and Materials (ASTM):
- B1-07.....Standard Specification for Hard-Drawn Copper Wire
- B3-07.....Standard Specification for Soft or Annealed Copper Wire
- B8-11.....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
- 81-83.....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements
- D. National Fire Protection Association (NFPA):
- 70-14.....National Electrical Code (NEC)
- 70E-12.....National Electrical Safety Code
- 99-12.....Health Care Facilities
- E. Underwriters Laboratories, Inc. (UL):
- 44-10 .....Thermoset-Insulated Wires and Cables
- 83-08 .....Thermoplastic-Insulated Wires and Cables
- 467-07 .....Grounding and Bonding Equipment

**PART 2 - PRODUCTS****2.1 GROUNDING AND BONDING CONDUCTORS**

- A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.
- B. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be bare solid copper. Bonding conductors shall be stranded for final connection to motors, transformers, and vibrating equipment.
- C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

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

## **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 cadmium-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 cadmium-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 cadmium-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 cadmium-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. Install grounding equipment in accordance with the NEC, as shown on the 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 transformer.
  - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- C. 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.
- D. For patient care area electrical power system grounding, conform to NFPA 99 and NEC.

#### **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.

**3.5 CONDUCTIVE PIPING**

- A. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.
- B. In operating rooms and at intensive care and coronary care type beds, bond the medical gas piping and medical vacuum piping at the outlets directly to the patient ground bus.

---END---

**SECTION 26 05 33**  
**RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

**1.3 QUALITY ASSURANCE**

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1. Shop Drawings:
    - a. Size and location of main feeders.
    - b. Size and location of panels and pull-boxes.
    - c. Layout of required conduit penetrations through structural elements.
    - d. Submit the following data for approval:
      - 1) Raceway types and sizes.
      - 2) Conduit bodies, connectors and fittings.
      - 3) Junction and pull boxes, types and sizes.
  2. Certifications: Two weeks prior to final inspection, submit the following:
    - a. Certification by the manufacturer that raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment conform to the requirements of the drawings and specifications.

- b. Certification by the Contractor that raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment have been properly installed.

### 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American National Standards Institute (ANSI):
- C80.1-05.....Electrical Rigid Steel Conduit
  - C80.3-05.....Steel Electrical Metal Tubing
  - C80.6-05.....Electrical Intermediate Metal Conduit
- C. National Fire Protection Association (NFPA):
- 70-14.....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
- 1-05.....Flexible Metal Conduit
  - 5-11.....Surface Metal Raceway and Fittings
  - 6-07.....Electrical Rigid Metal Conduit - Steel
  - 50-95.....Enclosures for Electrical Equipment
  - 360-13.....Liquid-Tight Flexible Steel Conduit
  - 467-13.....Grounding and Bonding Equipment
  - 514A-13.....Metallic Outlet Boxes
  - 514B-12.....Conduit, Tubing, and Cable Fittings
  - 514C-07.....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
  - 651-11.....Schedule 40 and 80 Rigid PVC Conduit and Fittings
  - 651A-11.....Type EB and A Rigid PVC Conduit and HDPE Conduit
  - 797-07.....Electrical Metallic Tubing
  - 1242-06.....Electrical Intermediate Metal Conduit - Steel
- E. National Electrical Manufacturers Association (NEMA):
- TC-2-13.....Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
  - TC-3-13.....PVC Fittings for Use with Rigid PVC Conduit and Tubing

FB1-12.....Fittings, Cast Metal Boxes and Conduit Bodies  
for Conduit, Electrical Metallic Tubing and  
Cable

FB2.10-13.....Selection and Installation Guidelines for  
Fittings for use with Non-Flexible Conduit or  
Tubing (Rigid Metal Conduit, Intermediate  
Metallic Conduit, and Electrical Metallic  
Tubing)

FB2.20-12.....Selection and Installation Guidelines for  
Fittings for use with Flexible Electrical  
Conduit and Cable

F. American Iron and Steel Institute (AISI):

S100-2007.....North American Specification for the Design of  
Cold-Formed Steel Structural Members

## **PART 2 - PRODUCTS**

### **2.1 MATERIAL**

A. Conduit Size: In accordance with the NEC, but not less than 0.75"  
unless otherwise shown. Where permitted by the NEC, 13 mm (0.5-inch)  
flexible conduit may be used for tap connections to recessed lighting  
fixtures.

B. Conduit:

1. Size: In accordance with the NEC, but not less than 0.75".
2. Rigid Steel Conduit (RMC): Shall conform to UL 6 and ANSI C80.1.
3. Rigid Intermediate Steel Conduit (IMC): Shall conform to UL 1242  
and ANSI C80.6.
4. Electrical Metallic Tubing (EMT): Shall conform to UL 797 and ANSI  
C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be  
permitted only with cable rated 600 V or less.
5. Flexible Metal Conduit: Shall conform to UL 1.
6. Liquid-tight Flexible Metal Conduit: Shall conform to UL 360.
7. Surface Metal Raceway: Shall conform to UL 5.

C. Conduit Fittings:

1. Rigid Steel and Intermediate Metallic Conduit Fittings:
  - a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
  - b. Standard threaded couplings, locknuts, bushings, conduit bodies,  
and elbows: Only steel or malleable iron materials are  
acceptable. Integral retractable type IMC couplings are also  
acceptable.

- c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
  - d. Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
  - e. Erickson (Union-Type) and Set Screw Type Couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
  - f. Sealing Fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
2. Electrical Metallic Tubing Fittings:
- a. Fittings and conduit bodies shall meet the requirements of UL 514B, ANSI C80.3, and NEMA FB1.
  - b. Only steel or malleable iron materials are acceptable.
  - c. Compression Couplings and Connectors: Concrete-tight and rain-tight, with connectors having insulated throats for conduit smaller than 2".
  - d. Setscrew Couplings and Connectors: Use setscrews of case-hardened steel with hex head and cup point, to firmly seat in wall of conduit for positive grounding for conduit 2" and larger.
  - 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. Liquid-tight Flexible Metal Conduit Fittings:
- a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
  - b. Only steel or malleable iron materials are acceptable.

- c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
- 5. Surface Metal Raceway Fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.
- 6. 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. UL-50 and UL-514A.
  - 2. Rustproof cast metal where required by the NEC or shown on drawings.
  - 3. Sheet Metal Boxes: Galvanized steel, except where shown on drawings.
- F. Metal Wireways: Equip with hinged covers, except as shown on drawings. Include couplings, offsets, elbows, expansion joints, adapters, hold-

down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

### **PART 3 - EXECUTION**

#### **3.1 PENETRATIONS**

A. Cutting or Holes:

1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the COR prior to drilling through structural elements.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except when permitted by the COR where working space is limited.

B. Firestop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal the gap around conduit to render it watertight.

#### **3.2 INSTALLATION, GENERAL**

- A. In accordance with UL, NEC, NEMA, as shown on drawings, and as specified herein.
- B. Raceway systems used for Essential Electrical Systems (EES) shall be entirely independent of other raceway systems.
- C. Install conduit as follows:
1. In complete mechanically and electrically continuous runs before pulling in cables or wires.
  2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
  3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new conduits.
  4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
  5. Cut conduits square, ream, remove burrs, and draw up tight.
  6. Independently support conduit at 2.4 M (8 feet) on centers with specified materials and as shown on drawings.

7. Do not use suspended ceilings, suspended ceiling supporting members, lighting fixtures, other conduits, cable tray, boxes, piping, or ducts to support conduits and conduit runs.
  8. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.
  9. Close ends of empty conduits with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
  10. Conduit installations under fume and vent hoods are prohibited.
  11. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid steel and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
  12. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
  13. Conduit bodies shall only be used for changes in direction, and shall not contain splices.
- D. Conduit Bends:
1. Make bends with standard conduit bending machines.
  2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
  3. Bending of conduits with a pipe tee or vise is prohibited.
- E. Layout and Homeruns:
1. Install conduit with wiring, including homeruns, as shown on drawings.
  2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted and approved by the COR.

### **3.3 CONCEALED WORK INSTALLATION**

- A. In Concrete:
1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
  2. Align and run conduit in direct lines.
  3. Install conduit through concrete beams only:
    - a. Where shown on the structural drawings.
    - b. As approved by the COR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.



4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
    - a. Conduit outside diameter larger than one-third of the slab thickness is prohibited.
    - b. Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.
    - c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (0.75-inch) of concrete around the conduits.
  5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground continuity through the conduits. Tightening setscrews with pliers is prohibited.
- B. Above Furred or Suspended Ceilings and in Walls:
1. Conduit for Conductors 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.

### **3.4 EXPOSED WORK INSTALLATION**

- A. Unless otherwise indicated on drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- B. Conduit for Conductors Above 600 V: Rigid steel. Mixing different types of conduits in the system is prohibited.
- C. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits in the system is prohibited.
- D. Align and run conduit parallel or perpendicular to the building lines.
- E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.

- F. Support horizontal or vertical runs at not over 2.4 M (8 feet) intervals.
- G. Surface Metal Raceways: Use only where shown on drawings.
- H. Painting:
  - 1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
  - 2. Paint all conduits containing cables rated over 600 V safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (2 inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6 M (20 feet) intervals in between.

### **3.5 WET OR DAMP LOCATIONS**

- A. Use rigid steel or IMC conduits unless as shown on drawings.
- B. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.
- C. Use rigid steel or IMC conduit within 1.5 M (5 feet) of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers, unless as shown on drawings. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.
- D. Conduits run on roof shall be supported with integral galvanized lipped steel channel, attached to UV-inhibited polycarbonate or polypropylene blocks every 2.4 M (8 feet) with 9 mm (3/8-inch) galvanized threaded rods, square washer and locknut. Conduits shall be attached to steel channel with conduit clamps.

### **3.6 MOTORS AND VIBRATING EQUIPMENT**

- A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.
- B. Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water.
- C. Provide a green equipment grounding conductor with flexible and liquid-tight flexible metal conduit.

**3.7 EXPANSION JOINTS**

- A. Conduits 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.

**3.8 CONDUIT SUPPORTS**

- A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and an additional 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.

### **3.9 BOX INSTALLATION**

- A. Boxes for Concealed Conduits:
  - 1. Flush-mounted.
  - 2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations or where more than the equivalent of 4-90 degree bends are necessary.
- C. Locate pullboxes so that covers are accessible and easily removed. Coordinate locations with piping and ductwork where installed above ceilings.
- D. Remove only knockouts as required. Plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
- E. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 600 mm (24 inch) center-to-center lateral spacing shall be maintained between boxes.
- F. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.
- G. Minimum size of outlet boxes for ground fault circuit interrupter (GFCI) receptacles is 100 mm (4 inches) square x 55 mm (2.125 inches) deep, with device covers for the wall material and thickness involved.

- H. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1."
- I. On all branch circuit junction box covers, identify the circuits with black marker.

- - - E N D - - -

**SECTION 26 27 26**  
**WIRING DEVICES****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, connection, and testing of wiring devices.

**1.2 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.
- B. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.
- C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Cables and wiring.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1. Shop Drawings:
    - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    - b. Include electrical ratings, dimensions, mounting details, construction materials, grade, and termination information.
  2. Manuals:
    - a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and information for ordering replacement parts.
    - b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
  3. Certifications: Two weeks prior to final inspection, submit the following.

- a. Certification by the manufacturer that the wiring devices conform to the requirements of the drawings and specifications.
- b. Certification by the Contractor that the wiring devices have been properly installed and adjusted.

### 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. National Fire Protection Association (NFPA):
  - 70-14.....National Electrical Code (NEC)
  - 99-12.....Health Care Facilities
- C. National Electrical Manufacturers Association (NEMA):
  - WD 1-10.....General Color Requirements for Wiring Devices
  - WD 6-08 .....Wiring Devices - Dimensional Specifications
- D. Underwriter's Laboratories, Inc. (UL):
  - 5-11.....Surface Metal Raceways and Fittings
  - 20-10.....General-Use Snap Switches
  - 231-07.....Power Outlets
  - 467-07.....Grounding and Bonding Equipment
  - 498-07.....Attachment Plugs and Receptacles
  - 943-11.....Ground-Fault Circuit-Interrupters
  - 1449-07.....Surge Protective Devices
  - 1472-96.....Solid State Dimming Controls

## PART 2 - PRODUCTS

### 2.1 RECEPTACLES

- A. General: All receptacles shall comply with NEMA, NFPA, UL, and as shown on the drawings.
  1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.
  2. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four minimum) and side wiring from four captively held binding screws.
- B. Duplex Receptacles: Hospital-grade, single phase, 20 ampere, 120 volts, 2-pole, 3-wire, NEMA 5-20R, with break-off feature for two-circuit operation.

1. Bodies shall be 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. Duplex Receptacles on Emergency Circuit:
  - a. In rooms without emergency powered general lighting, the emergency receptacles shall be of the self-illuminated type.
4. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit, hospital-grade, suitable for mounting in a standard outlet box, with end-of-life indication and provisions to isolate the face due to improper wiring.
  - a. Ground fault interrupter shall be consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. Device shall have nominal sensitivity to ground leakage current of 4-6 milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or - 1 milliampere) on the load side of the device. Device shall have a minimum nominal tripping time of 0.025 second.
  - b. Ground Fault Interrupter Duplex Receptacles (not hospital-grade) shall be the same as ground fault interrupter hospital-grade receptacles except for the hospital-grade listing.
- C. Receptacles; 20, 30, and 50 ampere, 250 Volts: Shall be complete with appropriate cord grip plug.
- D. Weatherproof Receptacles: Shall consist of a duplex receptacle, mounted in box with a gasketed, weatherproof, cast metal cover plate and cap over each receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.

## **2.2 TOGGLE SWITCHES**

- A. Toggle switches shall be totally enclosed tumbler type with nylon bodies. Handles shall be ivory in color unless otherwise specified or shown on the drawings.
  1. Switches installed in hazardous areas shall be explosion-proof type in accordance with the NEC and as shown on the drawings.
  2. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap



with break-off plaster ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.

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

### **2.3 WALL PLATES**

- A. Wall plates for switches and receptacles shall be type 302 stainless steel. Oversize plates are not acceptable.
- B. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.
- C. In areas requiring tamperproof wiring devices, wall plates shall be type 302 stainless steel, and shall have tamperproof screws and beveled edges.
- D. 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. Outlet boxes for toggle switches and manual dimming controls shall be mounted on the strike side of doors.
- E. Provide barriers in multigang outlet boxes to comply with the NEC.
- F. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material. Pay special attention to installations in cabinet work, and in connection with laboratory equipment.
- G. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the Contractor shall coordinate exact field location of the above items with other trades.
- H. Install wall switches 1.2 M (48 inches) above floor, with the toggle OFF

position down.

- I. Install wall dimmers 1.2 M (48 inches) above floor.
- J. Install receptacles 450 mm (18 inches) above floor, and 152 mm (6 inches) above counter backsplash or workbenches. Install specific-use receptacles at heights shown on the drawings.
- K. Install vertically mounted receptacles with the ground pin up. Install horizontally mounted receptacles with the ground pin to the right.
- L. When required or recommended by the manufacturer, use a torque screwdriver. Tighten unused terminal screws.
- M. Label device plates with a permanent adhesive label listing panel and circuit feeding the wiring device.

### **3.2 ACCEPTANCE CHECKS AND TESTS**

- A. Perform manufacturer's required field checks in accordance with the manufacturer's recommendations. In addition, include the following:
  - 1. Visual Inspection and Tests:
    - a. Inspect physical and electrical condition.
    - b. Vacuum-clean surface metal raceway interior. Clean metal raceway exterior.
    - c. Test wiring devices for damaged conductors, high circuit resistance, poor connections, inadequate fault current path, defective devices, or similar problems using a portable receptacle tester. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.
    - d. Test GFCI receptacles.
  - 2. Healthcare Occupancy Tests:
    - a. Test hospital grade receptacles for retention force per NFPA 99.

---END---

**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.
- B. Provide completely functioning communications systems.
- C. Comply with VAAR 852.236.91 and FAR clause 52.236-21 in circumstance of a need for additional detail or conflict between drawings, specifications, reference standards or code.

**1.2 REFERENCES**

- A. Abbreviations and Acronyms
  - 1. Refer to <http://www.cfm.va.gov/til/sdetail.asp> for Division 00, ARCHITECTURAL ABBREVIATIONS.
  - 2. Additional Abbreviations and Acronyms:

A	Ampere
AC	Alternating Current
AE	Architect and Engineer
AFF	Above Finished Floor
AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute
AWG	American Wire Gauge (refer to STP and UTP)
AWS	Advanced Wireless Services
BCT	Bonding Conductor for Telecommunications (also Telecommunications Bonding Conductor (TBC))
BDA	Bi-Directional Amplifier
BICSI	Building Industry Consulting Service International
BIM	Building Information Modeling
BOM	Bill of Materials
BTU	British Thermal Units
BUCR	Back-up Computer Room
BTS	Base Transceiver Station
CAD	AutoCAD
CBOPC	Community Based Out Patient Clinic
CBC	Coupled Bonding Conductor

CBOC	Community Based Out Patient Clinic (refer to CBOPC, OPC, VAMC)
CCS	TIP's Cross Connection System (refer to VCCS and HCCS)
CFE	Contractor Furnished Equipment
CFM	US Department of Veterans Affairs Office of Construction and Facilities Management
CFR	Consolidated Federal Regulations
CIO	Communication Information Officer (Facility, VISN or Region)
cm	Centimeters
CO	Central Office
COR	Contracting Officer Representative
CPU	Central Processing Unit
CSU	Customer Service Unit
CUP	Conditional Use Permit(s) - Federal/GSA for VA
dB	Decibel
dBm	Decibel Measured
dBmV	Decibel per milli-Volt
DC	Direct Current
DEA	United States Drug Enforcement Administration
DSU	Data Service Unit
EBC	Equipment Bonding Conductor
ECC	Engineering Control Center (refer to DCR, EMCR)
EDGE	Enhanced Data (Rates) for GSM Evolution
EDM	Electrical Design Manual
EMCR	Emergency Management Control Room (refer to DCR, ECC)
EMI	Electromagnetic Interference (refer to RFI)
EMS	Emergency Medical Service
EMT	Electrical Metallic Tubing or thin wall conduit
ENTR	Utilities Entrance Location (refer to DEMARC, POTS, LEC)
EPBX	Electronic Digital Private Branch Exchange

ESR	Vendor's Engineering Service Report
FA	Fire Alarm
FAR	Federal Acquisition Regulations in Chapter 1 of Title 48 of Code of Federal Regulations
FMS	VA's Headquarters or Medical Center Facility's Management Service
FR	Frequency (refer to RF)
FTS	Federal Telephone Service
GFE	Government Furnished Equipment
GPS	Global Positioning System
GRC	Galvanized Rigid Metal Conduit
GSM	Global System (Station) for Mobile
HCCS	TIP's Horizontal Cross Connection System (refer to CCS & VCCS)
HDPE	High Density Polyethylene Conduit
HDTV	Advanced Television Standards Committee High-Definition Digital Television
HEC	Head End Cabinets(refer to HEIC, PA)
HEIC	Head End Interface Cabinets(refer to HEC, PA)
HF	High Frequency (Radio Band; Re FR, RF, VHF & UHF)
HSPA	High Speed Packet Access
HZ	Hertz
IBT	Intersystem Bonding Termination (NEC 250.94)
IC	Intercom
ICRA	Infectious Control Risk Assessment
IDEN	Integrated Digital Enhanced Network
IDC	Insulation Displacement Contact
IDF	Intermediate Distribution Frame
ILSM	Interim Life Safety Measures
IMC	Rigid Intermediate Steel Conduit
IRM	Department of Veterans Affairs Office of Information Resources Management
ISDN	Integrated Services Digital Network

ISM	Industrial, Scientific, Medical
IWS	Intra-Building Wireless System
LAN	Local Area Network
LBS	Location Based Services, Leased Based Systems
LEC	Local Exchange Carrier (refer to DEMARC, PBX & POTS)
LED	Light Emitting Diode
LMR	Land Mobile Radio
LTE	Long Term Evolution, or 4G Standard for Wireless Data Communications Technology
M	Meter
MAS	Medical Administration Service
MATV	Master Antenna Television
MCR	Main Computer Room
MCOR	Main Computer Operators Room
MDF	Main Distribution Frame
MH	Manholes or Maintenance Holes
MHz	Megahertz ( $10^6$ Hz)
mm	Millimeter
MOU	Memorandum of Understanding
MW	Microwave (RF Band, Equipment or Services)
NID	Network Interface Device (refer to DEMARC)
NEC	National Electric Code
NOR	Network Operations Room
NRTL	OSHA Nationally Recognized Testing Laboratory
NS	Nurse Stations
NTIA	U.S. Department of Commerce National Telecommunications and Information Administration
OEM	Original Equipment Manufacturer
OI&T	Office of Information and Technology
OPC	VA's Outpatient Clinic (refer to CBOC, VAMC)
OSH	Department of Veterans Affairs Office of Occupational Safety and Health
OSHA	United States Department of Labor Occupational Safety

	and Health Administration
OTDR	Optical Time-Domain Reflectometer
PA	Public Address System (refer to HE, HEIC, RPEC)
PBX	Private Branch Exchange (refer to DEMARC, LEC, POTS)
PCR	Police Control Room (refer to SPCC, could be designated SCC)
PCS	Personal Communications Service (refer to UPCS)
PE	Professional Engineer
PM	Project Manager
PoE	Power over Ethernet
POTS	Plain Old Telephone Service (refer to DEMARC, LEC, PBX)
PSTN	Public Switched Telephone Network
PSRAS	Public Safety Radio Amplification Systems
PTS	Pay Telephone Station
PVC	Poly-Vinyl Chloride
PWR	Power (in Watts)
RAN	Radio Access Network
RBB	Rack Bonding Busbar
RE	Resident Engineer or Senior Resident Engineer
RF	Radio Frequency (refer to FR)
RFI	Radio Frequency Interference (refer to EMI)
RFID	RF Identification (Equipment, System or Personnel)
RMC	Rigid Metal Conduit
RMU	Rack Mounting Unit
RPEC	Radio Paging Equipment Cabinets(refer to HEC, HEIC, PA)
RTLS	Real Time Location Service or System
RUS	Rural Utilities Service
SCC	Security Control Console (refer to PCR, SPCC)
SMCS	Spectrum Management and Communications Security (COMSEC)
SFO	Solicitation for Offers

SME	Subject Matter Experts (refer to AHJ)
SMR	Specialized Mobile Radio
SMS	Security Management System
SNMP	Simple Network Management Protocol
SPCC	Security Police Control Center (refer to PCR, SMS)
STP	Shielded Balanced Twisted Pair (refer to UTP)
STR	Stacked Telecommunications Room
TAC	VA's Technology Acquisition Center, Austin, Texas
TCO	Telecommunications Outlet
TER	Telephone Equipment Room
TGB	Telecommunications Grounding Busbar (also Secondary Bonding Busbar (SBB))
TIP	Telecommunications Infrastructure Plant
TMGB	Telecommunications Main Grounding Busbar (also Primary Bonding Busbar (PBB))
TMS	Traffic Management System
TOR	Telephone Operators Room
TP	Balanced Twisted Pair (refer to STP and UTP)
TR	Telecommunications Room (refer to STR)
TWP	Twisted Pair
UHF	Ultra High Frequency (Radio)
UMTS	Universal Mobile Telecommunications System
UPCS	Unlicensed Personal Communications Service (refer to PCS)
UPS	Uninterruptible Power Supply
USC	United States Code
UTP	Unshielded Balanced Twisted Pair (refer to TP and STP)
UV	Ultraviolet
V	Volts
VAAR	Veterans Affairs Acquisition Regulation
VACO	Veterans Affairs Central Office
VAMC	VA Medical Center (refer to CBOC, OPC, VACO)



VCCS	TIP's Vertical Cross Connection System (refer to CCS and HCCS)
VHF	Very High Frequency (Radio)
VISN	Veterans Integrated Services Network (refers to geographical region)
VSWR	Voltage Standing Wave Ratio
W	Watts
WEB	World Electronic Broadcast
WiMAX	Worldwide Interoperability (for MW Access)
WI-FI	Wireless Fidelity
WMTS	Wireless Medical Telemetry Service
WSP	Wireless Service Providers

## B. Definitions:

1. Access Floor: Pathway system of removable floor panels supported on adjustable pedestals to allow cable placement in area below.
2. BNC Connector (BNC): United States Military Standard MIL-C-39012/21 bayonet-type coaxial connector with quick twist mating/unmating, and two lugs preventing accidental disconnection from pulling forces on cable.
3. Bond: Permanent joining of metallic parts to form an electrically conductive path to ensure electrical continuity and capacity to safely conduct any currents likely to be imposed to earth ground.
4. Bundled Microducts: All forms of jacketed microducts.
5. Conduit: Includes all raceway types specified.
6. Conveniently Accessible: Capable of being reached without use of ladders, or without climbing or crawling under or over obstacles such as, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.
7. Distributed (in house) Antenna System (DAS): An Emergency Radio Communications System installed for Emergency Responder (or first responders and Government personnel) use while inside facility to maintain contact with each respective control point; refer to Section 27 53 19, DISTRIBUTED RADIO ANTENNA (WITHIN BUILDING) EQUIPMENT AND SYSTEMS.
8. DEMARC, Extended DMARC or ENTR: Service provider's main point of demarcation owned by LEC or service provider and establishes a

- physical point where service provider's responsibilities for service and maintenance end. This point is called NID, in data networks.
9. Effectively Grounded: Intentionally bonded to earth through connections of low impedance having current carrying capacity to prevent buildup of currents and voltages resulting in hazard to equipment or persons.
  10. Electrical Supervision: Analyzing a system's function and components (i.e. cable breaks / shorts, inoperative stations, lights, LEDs and states of change, from primary to backup) on a 24/7/365 basis; provide aural and visual emergency notification signals to minimum two remote designated or accepted monitoring stations.
  11. Electrostatic Interference (ESI) or Electrostatic Discharge Interference: Refer to EMI and RFI.
  12. Emergency Call Systems: Wall units (in parking garages and stairwells) and pedestal mounts (in parking lots) typically provided with a strobe, camera and two-way audio communication functions.
  13. 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.
  14. Grounding Electrode Conductor: (GEC) Conductor connected to earth grounding electrode.
  15. Grounding Electrode System: Electrodes through which an effective connection to earth is established, including supplementary, communications system grounding electrodes and GEC.
  16. Grounding Equalizer or Backbone Bonding Conductor (BBC): Conductor that interconnects elements of telecommunications grounding infrastructure.
  17. 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.

18. Microducts: All forms of air blown fiber pathways.
19. Ohm: A unit of restive measurement.
20. Received Signal Strength Indication (RSSI): A measurement of power present in a received RF signal.
21. Service Provider Demarcation Point (SPDP): Not owned by LEC or service provider, but designated by Government as point within facility considered the DEMARC.
22. Sound (SND): Changing air pressure to audible signals over given time span.
23. System: Specific hardware, firmware, and software, functioning together as a unit, performing task for which it was designed.
24. Telecommunications Bonding Backbone (TBB): Conductors of appropriate size (minimum 53.49 mm<sup>2</sup> [1/0 AWG]) stranded copper wire, that connect to Grounding Electrode System and route to telecommunications main grounding busbar (TMGB) and circulate to interconnect various TGBs and other locations shown on drawings.
25. Voice over Internet Protocol (VoIP): A telephone system in which voice signals are converted to packets and transmitted over LAN network using Transmission Control Protocol (TCP)/Internet Protocol (IP). VA'S VoIP is not listed or coded for life and public safety, critical, emergency or other protection functions. When VoIP system or equipment is provided instead of PBX system or equipment, each TR (STR) and DEMARC requires increased AC power provided to compensate for loss of PBX's telephone instrument line power; and, to compensate for absence of PBX's UPS capability.
26. Wide Area Network (WAN): A digital network that transcends localized LANs within a given geographic location. VA'S WAN/LAN is not nationally listed or coded for life and public safety, critical, emergency or other safety functions.

### **1.3 APPLICABLE PUBLICATIONS**

- A. Applicability of Standards: Unless documents include more stringent requirements, applicable construction industry standards have same force and effect as if bound or copied directly into the documents to extent referenced. Such standards are made a part of these documents by reference.
  1. Each entity engaged in construction must be familiar with industry standards applicable to its construction activity.

2. Obtain standards directly from publication source, where copies of standards are needed to perform a required construction activity.

B. Government Codes, Standards and Executive Orders: Refer to

<http://www.cfm.va.gov/TIL/cPro.asp>:

1. Federal Communications Commission, (FCC) CFR, Title 47:
 

Part 15	Restrictions of use for Part 15 listed RF Equipment in Safety of Life Emergency Functions and Equipment Locations
Part 47	Chapter A, Paragraphs 6.1-6.23, Access to Telecommunications Service, Telecommunications Equipment and Customer Premises Equipment
Part 58	Television Broadcast Service
Part 73	Radio and Television Broadcast Rules
Part 90	Rules and Regulations, Appendix C
Form 854	Antenna Structure Registration
Chapter XXIII	National Telecommunications and Information Administration (NTIA, P/O Commerce, Chapter XXIII) the 'Red Book'- Chapters 7, 8 & 9 compliments CFR, Title 47, FCC Part 15, RF Restriction of Use and Compliance in "Safety of Life" Functions & Locations
2. US Department of Agriculture, (Title 7, USC, Chapter 55, Sections 2201, 2202 & 2203:RUS 1755 Telecommunications Standards and Specifications for Materials, Equipment and Construction:
 

RUS Bull 1751F-630	Design of Aerial Cable Plants
RUS Bull 1751F-640	Design of Buried Cable Plant, Physical Considerations
RUS Bull 1751F-643	Underground Plant Design
RUS Bull 1751F-815	Electrical Protection of Outside Plants,
RUS Bull 1753F-201	Acceptance Tests of Telecommunications Plants (PC-4)
RUS Bull 1753F-401	Splicing Copper and Fiber Optic Cables (PC-2)
RUS Bull 345-50	Trunk Carrier Systems (PE-60)
RUS Bull 345-65	Shield Bonding Connectors (PE-65)
RUS Bull 345-72	Filled Splice Closures (PE-74)
RUS Bull 345-83	Gas Tube Surge Arrestors (PE-80)
3. US Department of Commerce/National Institute of Standards Technology, (NIST):

- |                |   |
|----------------|---|
| FIPS PUB 1-1   | Telecommunications Information Exchange   |
| FIPS PUB 100/1 | Interface between Data Terminal Equipment (DTE)<br>Circuit Terminating Equipment for operation<br>with Packet Switched Networks, or Between Two<br>DTEs, by Dedicated Circuit |
| FIPS PUB 140/2 | Telecommunications Information Security<br>Algorithms   |
| FIPS PUB 143   | General Purpose 37 Position Interface between<br>DTE and Data Circuit Terminating Equipment   |
| FIPS 160/2     | Electronic Data Interchange (EDI),  |
| FIPS 175       | Federal Building Standard for<br>Telecommunications Pathway and Spaces  |
| FIPS 191       | Guideline for the Analysis of Local Area<br>Network Security  |
| FIPS 197       | Advanced Encryption Standard (AES)  |
| FIPS 199       | Standards for Security Categorization of<br>Federal Information and Information Systems   |
4. US Department of Defense, (DoD):
- |                 |   |
|-----------------|---|
| MIL-STD-188-110 | Interoperability and Performance Standards for<br>Data Modems   |
| MIL-STD-188-114 | Electrical Characteristics of Digital Interface<br>Circuits   |
| MIL-STD-188-115 | Communications Timing and Synchronizations<br>Subsystems  |
| MIL-C-28883     | Advanced Narrowband Digital Voice Terminals   |
| MIL-C-39012/21  | Connectors, Receptacle, Electrical, Coaxial,<br>Radio Frequency, (Series BNC (Uncabled), Socket<br>Contact, Jam Nut Mounted, Class 2) |
5. US Department of Health and Human Services:  
The Health Insurance Portability and Accountability Act of 1996  
(HIPAA) Privacy, Security and Breach Notification Rules
6. US Department of Justice:  
2010 Americans with Disabilities Act Standards for Accessible Design  
(ADAAD).
7. US Department of Labor, (DoL) - Public Law 426-62 - CFR, Title 29,  
Part 1910, Chapter XVII - Occupational Safety and Health  
Administration (OSHA), Occupational Safety and Health Standards):

- Subpart 7                      Approved NRTLs; obtain a copy at  
[http://www.osha.gov/dts/otpca/nrtl/faq\\_nrtl.htm](http://www.osha.gov/dts/otpca/nrtl/faq_nrtl.htm)  
1)
- Subpart 35                      Compliance with NFPA 101, Life Safety Code
- Subpart 36                      Design and Construction Requirements for Exit  
Routes
- Subpart 268                      Telecommunications
- Subpart 305                      Wiring Methods, Components, and Equipment for  
General Use
- Subpart 508                      Americans with Disabilities Act Accessibility  
Guidelines; technical requirement for  
accessibility to buildings and facilities by  
individuals with disabilities
8. US Department of Transportation, (DoT):
- a. Public Law 85-625, CFR, Title 49, Part 1, Subpart C - Federal  
        Aviation Administration (FAA):AC 110/460-ID & AC 707 / 460-2E -  
        Advisory Circulars Standards for Construction of Antenna Towers,  
        and 7450 and 7460-2 - Antenna Construction Registration Forms.
9. US Department of Veterans Affairs (VA): Office of Telecommunications  
(OI&T), MP-6, PART VIII, TELECOMMUNICATIONS, CHAPTER 5, AUDIO, RADIO  
AND TELEVISION (and COMSEC) COMMUNICATIONS SYSTEMS: Spectrum  
Management and COMSEC Service (SMCS), AHJ for:
- a. CoG, "Continuance of Government" communications guidelines and  
        compliance.
- b. COMSEC, "VA wide coordination and control of security classified  
        communication assets."
- c. COOP, "Continuance of Operations" emergency communications  
        guidelines and compliance.
- d. FAA, FCC, and US Department of Commerce National  
        Telecommunications and Information Administration, "VA wide RF  
        Co-ordination, Compliance and Licensing."
- e. Handbook 6100 - Telecommunications: Cyber and Information  
        Security Office of Cyber and Information Security, and Handbook  
        6500 - Information Security Program.
- f. Low Voltage Special Communications Systems "Design, Engineering,  
        Construction Contract Specifications and Drawings Conformity,  
        Proof of Performance Testing, VA Compliance and Life Safety  
        Certifications for CFM and VA Facility Low Voltage Special

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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/otpc/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 &amp; Construction of Health Care Facilities.

## 3. American Society of Mechanical Engineers (ASME):

A17.1 (2013)	Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices
17.3 (2011)	Safety Code for Existing Elevators and Escalators
17.4 (2009)	Guide for Emergency Personnel
17.5 (2011)	Elevator and Escalator Electrical Equipment

## 4. American Society for Testing and Materials (ASTM):

B1 (2001)	Standard Specification for Hard-Drawn Copper Wire
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- |                |  |
|----------------|--|
| B8 (2004)      | Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft   |
| D1557 (2012)   | Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft-lbf/ft <sup>3</sup> (2,700 kN-m/m <sup>3</sup> ) |
| D2301 (2004)   | Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape  |
| B258-02 (2008) | Standard Specification for Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors          |
| D709-01 (2007) | Standard Specification for Laminated Thermosetting Materials   |
| D4566 (2008)   | Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable                             |
5. American Telephone and Telegraph Corporation (AT&T) - Obtain following AT&T Publications at <https://ebiznet.sbc.com/SBCNEBS/>:
- |                     |  |
|---------------------|--|
| ATT-TP-76200 (2013) | Network Equipment and Power Grounding, Environmental, and Physical Design Requirements         |
| ATT-TP-76300 (2012) | Merged AT&T Affiliate Companies Installation Requirements                                      |
| ATT-TP-76305 (2013) | Common Systems Cable and Wire Installation and Removal Requirements - Cable Racks and Raceways |
| ATT-TP-76306 (2009) | Electrostatic Discharge Control  |
| ATT-TP-76400 (2012) | Detail Engineering Requirements  |
| ATT-TP-76402 (2013) | AT&T Raised Access Floor Engineering and Installation Requirements                             |
| ATT-TP-76405 (2011) | Technical Requirements for Supplemental Cooling Systems in Network Equipment Environments      |
| ATT-TP-76416 (2011) | Grounding and Bonding Requirements for Network Facilities                                      |
| ATT-TP-76440 (2005) | Ethernet Specification   |
| ATT-TP-76450 (2013) | Common Systems Equipment Interconnection Standards for AT&T Network Equipment Spaces           |
| ATT-TP-76461 (2008) | Fiber Optic Cleaning   |

- ATT-TP-76900 (2010) AT&T Installation Testing Requirement
- ATT-TP-76911 (1999) AT&T LEC Technical Publication Notice
6. British Standards Institution (BSI):
- BS EN 50109-2 Hand Crimping Tools - Tools for The Crimp Termination of Electric Cables and Wires for Low Frequency and Radio Frequency Applications - All Parts & Sections. October 1997
7. Building Industry Consulting Service International (BICSI):
- ANSI/BICSI 002-2011 Data Center Design and Implementation Best Practices
- ANSI/BICSI 004-2012 Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
- ANSI/NECA/BICSI 568-2006 Standard for Installing Commercial Building Telecommunications Cabling
- NECA/BICSI 607-2011 Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
- ANSI/BICSI 005-2013 Electronic Safety and Security (ESS) System Design and Implementation Best Practices
8. Electronic Components Assemblies and Materials Association, (ECA).
- ECA EIA/RS-270 (1973) Tools, Crimping, Solderless Wiring Devices - Recommended Procedures for User Certification
- EIA/ECA 310-E (2005) Cabinets, and Associated Equipment
9. Facility Guidelines Institute: 2010 Guidelines for Design and Construction of Health Care Facilities.
10. Insulated Cable Engineers Association (ICEA):
- ANSI/ICEA S-80-576-2002 Category 1 & 2 Individually Unshielded Twisted-Pair Indoor Cables for Use in Communications Wiring Systems
- ANSI/ICEA S-84-608-2010 Telecommunications Cable, Filled Polyolefin Insulated Copper Conductor, S-87-640 (2011) Optical Fiber Outside Plant Communications Cable
- ANSI/ICEA

- |                       |   |
|-----------------------|---|
| S-90-661-2012         | Category 3, 5, & 5e Individually Unshielded Twisted-Pair Indoor Cable for Use in General Purpose and LAN Communication Wiring Systems                             |
| S-98-688 (2012)       | Broadband Twisted Pair Cable Aircore, Polyolefin Insulated, Copper Conductors   |
| S-99-689 (2012)       | Broadband Twisted Pair Cable Filled, Polyolefin Insulated, Copper Conductors  |
| ICEA S-102-700 (2004) | Category 6 Individually Unshielded Twisted Pair Indoor Cables (With or Without an Overall Shield) for use in Communications Wiring Systems Technical Requirements |
11. Institute of Electrical and Electronics Engineers (IEEE):
- |   |   |
|---|---|
| ISSN 0739-5175                              | March-April 2008 Engineering in Medicine and Biology Magazine, IEEE (Volume: 27, Issue:2) Medical Grade-Mission Critical-Wireless Networks      |
| IEEE C2-2012 C62.41.2-2002/ Cor 1-2012 IEEE | National Electrical Safety Code (NESC) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits 4) |
| C62.45-2002                                 | IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits                           |
| 81-2012 IEEE                                | Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System                                     |
| 100-1992                                    | IEEE the New IEEE Standards Dictionary of Electrical and Electronics Terms  |
| 602-2007                                    | IEEE Recommended Practice for Electric Systems in Health Care Facilities  |
| 1100-2005                                   | IEEE Recommended Practice for Powering and Grounding Electronic Equipment   |
12. International Code Council:
- |              |   |
|--------------|---|
| AC193 (2014) | Mechanical Anchors in Concrete Elements |
|--------------|---|
13. International Organization for Standardization (ISO):

- ISO/TR 21730 (2007) Use of Mobile Wireless Communication and Computing Technology in Healthcare Facilities - Recommendations for Electromagnetic Compatibility (Management of Unintentional Electromagnetic Interference) with Medical Devices
14. National Electrical Manufacturers Association (NEMA):
- NEMA 250 (2008) Enclosures for Electrical Equipment (1,000V Maximum)
- ANSI C62.61 (1993) American National Standard for Gas Tube Surge Arresters on Wire Line Telephone Circuits
- ANSI/NEMA FB 1 (2012) Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing EMT) and Cable
- ANSI/NEMA OS 1 (2009) Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
- NEMA SB 19 (R2007) NEMA Installation Guide for Nurse Call Systems
- TC 3 (2004) Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing
- NEMA VE 2 (2006) Cable Tray Installation Guidelines
15. National Fire Protection Association (NFPA):
- 70E-2015 Standard for Electrical Safety in the Workplace
- 70-2014 National Electrical Code (NEC)
- 72-2013 National Fire Alarm Code
- 75-2013 Standard for the Fire Protection of Information Technological Equipment
- 76-2012 Recommended Practice for the Fire Protection of Telecommunications Facilities
- 77-2014 Recommended Practice on Static Electricity
- 90A-2015 Standard for the Installation of Air Conditioning and Ventilating Systems
- 99-2015 Health Care Facilities Code
- 101-2015 Life Safety Code
- 241 Safeguarding construction, alternation and Demolition Operations
- 255-2006 Standard Method of Test of Surface Burning Characteristics of Building Materials

- 262 - 2011 Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
- 780-2014 Standard for the Installation of Lightning Protection Systems
- 1221-2013 Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems
- 5000-2015 Building Construction and Safety Code
16. Society for Protective Coatings (SSPC):  
SSPC SP 6/NACE No.3 (2007) Commercial Blast Cleaning
17. Society of Cable Telecommunications Engineers (SCTE):  
ANSI/SCTE 15 2006 Specification for Trunk, Feeder and Distribution Coaxial Cable
18. Telecommunications Industry Association (TIA):
- TIA-120 Series Telecommunications Land Mobile communications (APCO/Project 25) (January 2014)
- TIA TSB-140 Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems (2004)
- TIA-155 Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T (2010)
- TIA TSB-162-A Telecommunications Cabling Guidelines for Wireless Access Points (2013)
- TIA-222-G Structural Standard for Antenna Supporting Structures and Antennas (2014)
- TIA/EIA-423-B Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits (2012)
- TIA-455-C General Requirements for Standard Test Procedures for Optical Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components (August 2014)
- TIA-455-53-A FOTP-53 Attenuation by Substitution Measurements for Multimode Graded-Index Optical Fibers in Fiber Assemblies (Long Length) (September 2001)

TIA-455-61-A	FOTP-61 Measurement of Fiber of Cable Attenuation Using an OTDR (July 2003)
TIA-472D000-B	Fiber Optic Communications Cable for Outside Plant Use (July 2007)
ANSI/TIA-492-B	62.5-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-568	Revision/Edition: C Commercial Building Telecommunications Cabling Standard Set: (TIA-568-C.0-2 Generic Telecommunications Cabling for Customer Premises (2012), TIA-568-C.1-1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements (2012), TIA-568-C.2 Commercial Building Telecommunications Cabling Standard-Part 2: Balanced Twisted Pair Cabling Components (2009), TIA-568-C.3-1 Optical Fiber Cabling Components Standard, (2011) AND TIA-568-C.4 Broadband Coaxial Cabling and Components Standard (2011) with addendums and erratas
TIA-569	Revision/Edition C Telecommunications Pathways and Spaces (March 2013)

TIA-574	Position Non-Synchronous Interface between Data Terminal equipment and Data Circuit Terminating Equipment Employing Serial Binary Interchange (May 2003)
TIA/EIA-590-A	Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant (July 2001)
TIA-598-D	Optical Fiber Cable Color Coding (January 2005)
TIA-604-10-B	Fiber Optic Connector Intermateability Standard (August 2008)
ANSI/TIA-606-B	Administration Standard for Telecommunications Infrastructure (2012)
TIA-607-B	Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises (January 2013)
TIA-613	High Speed Serial Interface for Data Terminal Equipment and Data Circuit Terminal Equipment (September 2005)
ANSI/TIA-758-B	Customer-owned Outside Plant Telecommunications Infrastructure Standard (April 2012)
ANSI/TIA-854	A Full Duplex Ethernet Specification for 1000 Mb/s (1000BASE-TX) Operating over Category 6 Balanced Twisted-Pair Cabling (2001)
ANSI/TIA-862-A	Building Automation Systems Cabling Standard (April 2011)
TIA-942-A	Telecommunications Infrastructure Standard for Data Centers (March 2014)
TIA-1152	Requirements for Field Testing Instruments and Measurements for Balanced Twisted Pair Cabling (September 2009)
TIA-1179	Healthcare Facility Telecommunications Infrastructure Standard (July 2010)

#### 1.4 SINGULAR NUMBER

- A. Where any device or part of equipment is referred in singular number (such as " rack"), reference applies to as many such devices as are required to complete installation.



**1.5 RELATED WORK**

- A. Specification Order of Precedence: FAR Clause 52.236-21, VAAR Clause 852.236-71.
  - 1. Field Cutting and Patching: Section 09 91 00, PAINTING.
  - 2. Additional submittal requirements: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
  - 3. Availability and source of references and standards specified in applicable publications: Section 01 42 19, REFERENCE STANDARDS.
  - 4. Requirements for non-hazardous building construction and demolition waste: Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
  - 5. Closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction: Section 07 84 00, FIRESTOPPING.
  - 6. Sealant and caulking materials and their application: Section 07 92 00, JOINT SEALANTS.
  - 7. General electrical requirements that are common to more than one section of Division 26: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
  - 8. Conduit and boxes: Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
  - 9. Wiring devices: Section 26 27 26, WIRING DEVICES.

**1.6 ADMINISTRATIVE REQUIREMENTS**

- A. Assign a single communications project manager to serve as point of contact for Government, contractor, and design professional.
- B. Be proactive in scheduling work.
  - 1. Use of premises is restricted at times directed by COR.
  - 2. Movement of materials: Unload materials and equipment delivered to site.
  - 3. Coordinate installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
  - 4. Sequence, coordinate, and integrate installations of materials and equipment for efficient flow of Work.
  - 5. Coordinate connection of materials, equipment, and systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies; provide required connection for each service.

6. Initiate and maintain discussion regarding schedule for ceiling construction and install cables to meet that schedule.
- C. Contact the Office of Telecommunications, Special Communications Team (0050P2H3) (202)461-5310 to have a Government-accepted Telecommunications COR assigned to project for telecommunications review, equipment and system approval and coordination with other VA personnel.
- D. Communications Project Manager Responsibilities:
  1. Assume responsibility for overall telecommunications system integration and coordination of work among trades, subcontractors, and authorized system installers.
  2. Coordinate with related work indicated on drawings or specified.
  3. Manage work related to telecommunications system installation in a manner approved by manufacturer.

#### **1.7 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Provide parts list including quantity of spare parts.
- C. Provide manufacturer product information. Government reserves the right to require a list of installations where products have been in operation.
- D. Provide Source Quality Control Submittal:
  1. Submit written certification from OEM indicating that proposed supervisor of installation and proposed provider of warranty maintenance are authorized representatives of OEM. Include individual's legal name, contact information and OEM credentials in certification.
  2. Submit written certification from OEM that wiring and connection diagrams meet Government Life Safety Guidelines, NFPA, NEC, NRTL, these specifications, and Joint Commission requirements and instructions, requirements, recommendations, and guidance set forth by OEM for the proper performance of system.
  3. Pre-acceptance Certification: Certification in accordance with procedure outlined in Section 01 00 00, GENERAL REQUIREMENTS and specific Division 27 qualification documentation.
- E. Installer Qualifications: Submit three installations of similar size and complexity furnished and installed by installer; include:
  1. Installation location and name.

2. Owner's name and contact information including, address, telephone and email.
  3. Date of project start and date of final acceptance.
  4. System project number.
  5. Three paragraph description of each system related to this project; include function, operation, and installation.
- F. Provide delegated design submittals (e.g. seismic support design).
- G. Submittals are required for all equipment anchors and supports. Include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion,) associated with equipment or conduit. Anchors and supports to resist seismic load based on seismic design categories per section 4.0 of VA seismic design requirements H-18-8 dated August, 2013.
- H. Test Equipment List:
1. Supply test equipment of accuracy better than parameters to be tested.
  2. Submit test equipment list including make and model number:
    - a. ANSI/TIA-1152 Level IIIe twisted pair cabling test instrument.
    - b. Land Mobile Radio Modulation Analyzer and Signal Analyzer, Vector Network Analyzer, Spectrum Analyzer.
  3. Supply only test equipment with a calibration tag from Government-accepted calibration service dated not more than 12 months prior to test.
  4. Provide sample test and evaluation reports.
- I. Submittal Drawings:
1. Telecommunications Space Plans/Elevations: Provide enlarged floor plans of telecommunication spaces indicating layout of equipment and devices, including receptacles and grounding provisions. Submit detailed plan views and elevations of telecommunication spaces showing racks, termination blocks, and cable paths. Include following rooms:
    - a. 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.

J. 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 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 formats as determined by COR.

7. Deliver four complete sets of electronic record wiring diagrams to COR on portable storage drive.

D. Service Qualifications: Submit name and contact information of service organizations providing service to this installation within four hours of receipt of notification service is needed.

#### **1.9 MAINTENANCE MATERIAL SUBMITTALS**

A. After approval and prior to installation, furnish COR with the following:

1. A 300 mm (12 inch) length of each type and size of wire and cable along with tag from coils of reels from which samples were taken.
2. One coupling, bushing and termination fitting for each type of conduit.
3. Samples of each hanger, clamp and supports for conduit and pathways.
4. Duct sealing compound.

#### **1.10 QUALITY ASSURANCE**

A. Manufacturer's Qualifications: Manufacturer must produce, as a principal product, the equipment and material specified for this project, and have manufactured item for at least three years.

B. Product and System Qualification:

1. OEM must have three installations of equipment submitted presently in operation of similar size and type as this project, that have continuously operated for a minimum of three years.
2. Government reserves the right to require a list of installations where products have been in operation before approval.
3. Authorized representative of OEM must be responsible for design, satisfactory operation of installed system, and certification.

C. Trade Contractor Qualifications: Trade contractor must have completed three or more installations of similar systems of comparable size and complexity with regards to coordinating, engineering, testing, certifying, supervising, training, and documentation. Identify these installations as a part of submittal.

D. System Supplier Qualifications: System supplier must be authorized by OEM to warranty installed equipment.

E. Telecommunications technicians assigned to system must be trained, and certified by OEM on installation and testing of system; provide written evidence of current OEM certifications for installers.

F. Manufactured Products:

1. Comply with FAR clause 52.236-5 for material and workmanship.

2. When more than one unit of same class of equipment is required, units must be product of a single manufacturer.
  3. Equipment Assemblies and Components:
    - a. Components of an assembled unit need not be products of same manufacturer.
    - b. Manufacturers of equipment assemblies, which include components made by others, to assume complete responsibility for final assembled unit.
    - c. Provide compatible components for assembly and intended service.
    - d. Constituent parts which are similar must be product of a single manufacturer.
  4. Identify factory wiring on equipment being furnished and on wiring diagrams.
- G. Testing Agencies: Government reserves the option of witnessing factory tests. Notify COR minimum 15 working days prior to manufacturer performing the factory tests.
1. When equipment fails to meet factory test and re-inspection is required, contractor is liable for additional expenses, including expenses of Government.

#### **1.11 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery and Acceptance Requirements:
1. Government's approval of submittals must be obtained for equipment and material before delivery to job site.
  2. Deliver and store materials to job site in OEM's original unopened containers, clearly labeled with OEM's name and equipment catalog numbers, model and serial identification numbers for COR to inventory cable, patch panels, and related equipment.
- B. Storage and Handling Requirements:
1. Equipment and materials must be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:
    - a. Store and protect equipment in a manner that precludes damage or loss, including theft.
    - b. Protect painted surfaces with factory installed removable heavy kraft paper, sheet vinyl or equivalent.
    - c. Protect enclosures, equipment, controls, controllers, circuit protective devices, and other like items, against entry of foreign matter during installation; vacuum clean both inside and outside before testing and operating.

C. Coordinate storage.

#### **1.12 FIELD CONDITIONS**

- A. Where variations from documents are requested in accordance with GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, connecting work and related components must include additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.
- B. A contract adjustment or additional time will not be granted because of field conditions pursuant to FAR 52.236-2 and FAR 52.236-3; a contract adjustment or additional time will not be granted for additional work required for complete and usable construction and systems pursuant to FAR 52.246-12.

#### **1.13 WARRANTY**

- A. Comply with FAR clause 52.246-21., 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.

### **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.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Penetrations and Sleeves:
  - 1. Lay out penetration and sleeve openings in advance, to permit provision in work.
  - 2. Set sleeves in forms before concrete is poured.
  - 3. Set sleeves prior to installation of structure for passage of pipes, conduit, ducts, etc.
  - 4. Provide sleeves and packing materials at penetrations of foundations, walls, slabs, partitions, and floors.



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5. Make sleeves that penetrate outside walls, basement slabs, footings, and beams waterproof.
  6. Fill slots, sleeves and other openings in floors or walls if not used.
    - a. Fill spaces in openings after installation of conduit or cable.
    - b. Provide fill for floor penetrations to prevent passage of water, smoke, fire, and fumes.
    - c. Provide fire resistant fill in rated floors and walls, to prevent passage of air, smoke and fumes.
  7. Install sleeves through floors watertight and extend minimum 50.8 mm (2 inches) above floor surface.
  8. Match and set sleeves flush with adjoining floor, ceiling, and wall finishes where raceways passing through openings are exposed in finished rooms.
  9. Annular space between conduit and sleeve must be minimum 6 mm (1/4 inch).
  10. Do not provide sleeves for slabs-on-grade, unless specified or indicated otherwise.
  11. Comply with requirements for firestopping, for sleeves through rated fire walls and smoke partitions.
  12. Do not support piping risers or conduit on sleeves.
  13. Identify unused sleeves and slots for future installation.
  14. Provide core drilling if walls are poured or otherwise constructed without sleeves and wall penetration is required; do not penetrate structural members.
- B. Core Drilling:
1. Avoid core drilling whenever possible.
  2. Coordinate openings with other trades and utilities, and prevent damage to structural reinforcement.
  3. Investigate existing conditions in vicinity of required opening prior to coring, including an x-ray of floor if determined necessary by competent person or COR.
  4. Protect areas from damage.
- C. Verification of In-Place Conditions:
1. Verify location, use and status of all material, equipment, and utilities that are specified, indicated, or determined necessary for removal.

- a. Verify materials, equipment, and utilities to be removed are inactive, not required, or in use after completion of project.
  - b. Replace with equivalent any material, equipment and utilities that were removed by contractor that are required to be left in place.
2. Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under following conditions and then only after arranging to provide temporary utility services, according to requirements indicated:
- a. Notify COR in writing at least 14 days in advance of proposed utility interruptions.
  - b. Do not proceed with utility interruptions without Government's written permission.
- D. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs for floor, wall and ceiling mounting of equipment as required.
- E. Provide steel supports and hardware for installation of hangers, anchors, guides, and other support hardware.
- F. Obtain and analyze catalog data, weights, and other pertinent data required for coordination of equipment support provisions and installation.
- G. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly that would void warranty.

### **3.2 INSTALLATION - GENERAL**

- A. Coordinate systems, equipment, and materials installation with other building components.
- B. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings.
- C. Conform to VAAR 852.236.91 arrangements indicated, recognizing that work may be shown in diagrammatic form or have been impracticable to detail all items because of variances in manufacturers' methods of achieving specified results.
- D. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed in both exposed and un-exposed spaces.
- E. Install equipment according to manufacturers' written instructions.
- F. Install wiring and cabling between equipment and related devices.

- G. Install cabling, wiring, and equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum interference of adjacent other installations.
- H. Provide access panel or doors where units are concealed behind finished surfaces.
- I. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for wiring, cabling, and equipment installations.
- J. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide maximum headroom and access for service and maintenance as possible.
- K. Install systems, materials, and equipment giving priority to systems required to be installed at a specified slope.
- L. Avoid interference with structure and with work or other trades, preserving adequate headroom and clearing doors and passageways to satisfaction of COR and code requirements.
- M. Install equipment and cabling to distribute equipment loads on building structural members provided for equipment support under other sections; install and support roof-mounted equipment on structural steel or roof curbs as appropriate.
- N. Provide supplementary or miscellaneous items, appurtenances, devices and materials for a complete installation.

### **3.3 EQUIPMENT INSTALLATION**

- A. Locate equipment as close as practical to locations shown on drawings.
- B. Note locations of equipment requiring access on record drawings.
- C. Access and Access Panels: Verify access panel locations and construction with COR.
- D. Inaccessible Equipment:
  - 1. Where Government determines that contractor has installed equipment not conveniently accessible for operation and maintenance, equipment must be removed and reinstalled as directed and without additional cost to Government.

### **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. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.
- C. Protect adjacent installations during cutting and patching operations.
- D. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- E. Patch finished surfaces and building components using new materials specified for original installation and experienced installers.

**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

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verify project compliance for same material or equipment, Government reserves right to obtain compensation from contractor to defray cost of additional site visits that result from project construction or testing deficiencies and incompleteness, incorrect information, or non-compliance with project provisions.

1. COR will notify contractor, of hourly rates and travel expenses for additional site visits, and will issue an invoice to Contractor for additional site visits.
2. Contractor is not be eligible for extensions of project schedule or additional charges resulting from additional site visits that result from project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions.

G. Tests:

1. Interim inspection is required at approximately 50 percent of installation.
2. Request inspection ten working days prior to interim inspection start date by notifying COR in writing; this inspection must verify equipment and system being provided adheres to installation, mechanical and technical requirements of construction documents.
3. Inspection to be conducted by OEM and factory-certified contractor representative, and witnessed by COR, facility and SMCS 0050P2H3 representatives.
4. Check each item of installed equipment to ensure appropriate NRTL listing labels and markings are fixed in place.
5. Verify cabling terminations in DEMARC, MCR, TER, SCC, ECC, TRs and head end rooms, workstation locations and TCO adhere to color code for T568B pin assignments and cabling connections are in compliance with TIA standards.
6. Visually confirm minimum Category 6 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. Coaxial cable field inspection tests via attenuation measurements on factory reels; provide results along with OEM certification for factory reel tests.

- b. Baseband cable field inspection tests via attenuation measurements on factory reels and provide results along with OEM certification for factory reel tests.
  - 10. Relocate failed cable reels to a secured location for inventory, as directed by COR, and then remove from project site within two working days; provide COR with written confirmation of defective cable reels removal from project site.
  - 11. Provide results of interim inspections to COR.
  - 12. If major or multiple deficiencies are discovered, additional interim inspections could be required until deficiencies are corrected, before permitting further system installation.
    - a. Additional inspections are scheduled at direction of COR.
    - b. Re-inspection of deficiencies noted during interim inspections, must be part of system's Final Acceptance Proof of Performance Test.
    - c. The interim inspection cannot affect the system's completion date unless directed by COR.
  - 13. Facility COR will ensure test documents become a part of system's official documentation package.
- H. Acceptance Test:
- 1. Schedule an acceptance test date after system has been pretested, and pretest results and certification submitted to COR.
  - 2. Give COR fifteen working days written notice prior to date test is expected to begin; include expected duration of time for test in notification.
  - 3. Test in the presence of the following:
    - a. COR.
    - b. OEM representatives.
    - c. VACO:
      - 1) CFM representative.
      - 2) AHJ-SMCS 0050P2H3, (202)461-5310.
    - d. VISN-CIO, Network Officer and VISN representatives.
    - e. Facility:
      - 1) FMS Service Chief, Bio-Medical Engineering and facility representatives.
      - 2) OI&T Service Chief and OI&T representatives.
      - 3) Safety Officer, Police Chief and facility safety representatives.

- f. Local Community Safety Personnel:
  - 1) Fire Marshal representative.
  - 2) Disaster Coordinator representative.
  - 3) EMS Representatives: Police, Sherriff, City, County or State representatives.
- 4. Test system utilizing accepted test equipment to certify proof of performance and Life and Public Safety compliance, FCC, NRTL, NFPA and OSHA compliance.
  - a. Rate system as acceptable or unacceptable at conclusion of test; make only minor adjustments and connections required to show proof of performance.
    - 1) Demonstrate and verify that system complies with performance requirements under operating conditions.
    - 2) Failure of any part of system that precludes completion of system testing, and which cannot be repaired within four hours, terminates acceptance test of that portion of system.
    - 3) Repeated failures that result in a cumulative time of eight hours to affect repairs is cause for entire system to be declared unacceptable.
    - 4) If system is declared unacceptable, retesting must be rescheduled at convenience of Government and costs borne by the contractor.
- I. Acceptance Test Procedure:
  - 1. Physical and Mechanical Inspection: The test team representatives must tour major areas to determine system and sub-systems are completely and properly installed and are ready for acceptance testing.
  - 2. A system inventory including available spare parts must be taken at this time.
  - 3. Each item of installed equipment must be re-checked to ensure appropriate NRTL (i.e. UL) certification listing labels are affixed.
  - 4. Confirm that deficiencies reported during Interim Inspections and Pretesting are corrected prior to start of Acceptance Test.
  - 5. Inventory system diagrams, record drawings, equipment manuals, pretest results.
  - 6. Failure of system to meet installation requirements of specifications is grounds for terminating testing and to schedule re-testing.

## J. Operational Test:

1. Individual Item Test: VACO AHJ representative (SMCS 0050P2H3) may select individual items of ERRCS 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.

K. Acceptance Test Conclusion: Reschedule testing on deficiencies and shortages with COR, after COR and SMCS AHJ jointly agree to results of the test, using the generated punch list or discrepancy list. Perform retesting to comply with these specifications at contractor's expense.

## L. Proof of Performance Certification:

1. If system is declared acceptable, AHJ (SMCS 0050P2H3) provides COR notice stating system processes to required operating standards and functions and is Government accepted for use by facility.
2. Validate items with COR needing to be provided to complete project contract (i.e. charts & diagrams, manuals, spare parts, system warranty documents executed, etc.). Once items have been provided, COR contacts FMS service chief to turn over system from CFM oversight for beneficial use by facility.
3. If system is declared unacceptable without conditions, rescheduled testing expenses are to be borne by contractor.

**3.7 CLEANING**

- A. Remove debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from project site and clean work area, prior to final inspection and acceptance of work.
- B. Put building and premises in neat and clean condition.
- C. Remove debris on a daily basis.
- D. Remove unused material, during progress of work.



- E. Perform cleaning and washing required to provide acceptable appearance and operation of equipment to satisfaction of COR.
- F. Clean exterior surface of all equipment, including concrete residue, dirt, and paint residue, after completion of project.
- G. Perform final cleaning prior to project acceptance by COR.
- H. Remove paint splatters and other spots, dirt, and debris; touch up scratches and mars of finish to match original finish.
- I. Clean devices internally using methods and materials recommended by manufacturer.
- J. Tighten wiring connectors, terminals, bus joints, and mountings, to include lugs, screws and bolts according to equipment manufacturer's published torque tightening values for equipment connectors. In absence of published connection or terminal torque values, comply with torque values specified in UL 486A-486B.

### 3.8 TRAINING

- A. Provide training in accordance with subsection, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.
- B. Provide training for equipment or system as required in each associated specification.
- C. Develop and submit training schedule for approval by COR, at least 30 days prior to planned training.

### 3.9 PROTECTION

- A. Protection of Fireproofing:
  - 1. Install clips, hangers, clamps, supports and other attachments to surfaces to be fireproofed, if possible, prior to start of spray fireproofing work.
  - 2. Install conduits and other items that would interfere with proper application of fireproofing after completion of spray fire proofing work.
  - 3. Patch and repair fireproofing damaged due to cutting or course of work must be performed by installer of fireproofing and paid for by trade responsible for damage.
- B. Maintain equipment and systems until final acceptance.
- C. Ensure adequate protection of equipment and material during installation and shutdown and during delays pending final test of systems and equipment because of seasonal conditions.

- - - E N D - - -

**SECTION 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.

**1.2 RELATED WORK**

- A. Low voltage wiring: Section 27 10 00, STRUCTURED CABLING.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- B. 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 mm<sup>2</sup> (10 AWG) and smaller. Identify all grounding conductors with continuous green insulation color, except identify wire sizes 25 mm<sup>2</sup> (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 mm<sup>2</sup> (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 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. 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.

E. 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.

F. 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, antenna headend equipment room, to telecommunications main grounding busbar in Demarc room after testing bond to verify bonding conductor for telecommunications from grounding electrode conductor is installed per NEC. Size telecommunications bonding backbone conductor as specified in TIA-607-B.

- 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. 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.
  - 6. Bonding Jumpers:

- a. Assemble bonding jumpers using insulated ground wire of size and type shown on drawings or use a minimum of 16 mm<sup>2</sup> (6 AWG) insulated copper wire terminated with compression connectors of proper size for conductors.
  - b. Use connector manufacturer's compression tool.
- 7. Bonding Jumper Fasteners:
  - a. Conduit: Connect bonding jumpers using lugs on grounding bushings or clamp pads on push-type conduit fasteners. Where appropriate, use zinc-plated external tooth lockwashers or Belleville Washers.
  - b. Wireway and Cable Tray: 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.
    - 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.
- I. 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 mm<sup>2</sup> (6 AWG) bonding jumper.
- J. 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 mm<sup>2</sup> (6 AWG) ground wire bonding jumpers.

K. 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.

L. 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 mm<sup>2</sup> (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.

M. Communications Raceway Grounding:

1. Conduit: Use insulated 16 mm<sup>2</sup> (6 AWG) bonding jumpers to bond metallic conduit at both ends and intermediate metallic enclosures to ground.
2. Cable Tray Systems: Use insulated 16 mm<sup>2</sup> (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.

N. 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 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.

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**SECTION 27 05 33**  
**RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This section specifies conduit, fittings, and boxes to form complete, coordinated, raceway systems. Raceways are required for communications cabling unless shown or specified otherwise.

**1.2 RELATED WORK**

- A. Mounting board for Telecommunication Rooms: Section 06 10 00, ROUGH CARPENTRY.
- B. Sealing around penetrations to maintain integrity of fire rated construction: Section 07 84 00, FIRESTOPPING.
- C. Fabrications for deflection of water away from building envelope at penetrations: Section 07 60 00, FLASHING AND SHEET METAL.
- D. Sealing around conduit penetrations through building envelope to prevent moisture migration into building: Section 07 92 00, JOINT SEALANTS.
- E. Identification and painting of conduit and other devices: Section 09 91 00, PAINTING.
- F. 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. In accordance with Section 27 50 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, submit the following:
1. Size and location of cabinets, splice boxes and pull boxes.
  2. Layout of required conduit penetrations through structural elements.
  3. Catalog cuts marked with specific item proposed and area of application identified.
- B. Certification: Provide letter prior to final inspection, certifying material is in accordance with construction documents and properly installed.

**PART 2 - PRODUCTS****2.1 MATERIAL**

- A. Minimum Conduit Size: 19 mm (3/4 inch).
- B. Conduit:
1. Rigid Galvanized Steel: Conform to UL 6, ANSI C80.1.
  2. Rigid Aluminum: Conform to UL 6A, ANSI C80.5.



3. Rigid Intermediate Steel Conduit (IMC): Conform to UL 1242, ANSI C80.6.
  4. 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.
  5. Flexible Galvanized Steel Conduit: Conform to UL 1.
  6. Liquid-tight Flexible Metal Conduit: Conform to UL 360.
  7. Direct Burial Plastic Conduit: Conform to UL 651 and UL 651A, heavy wall PVC, or high density polyethylene (HDPE).
  8. Surface Metal Raceway: Conform to UL 5.
  9. 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. Rigid Aluminum Conduit Fittings:
  - a. Standard Threaded Couplings, Locknuts, Bushings, and Elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are not permitted.
  - b. Locknuts and Bushings: As specified for rigid steel and IMC conduit.
  - c. Set Screw Fittings: Not permitted for use with aluminum conduit.
3. 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.
4. 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.
5. 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.
- 6. Direct Burial Plastic Conduit Fittings: Provide fittings meeting requirements of UL 514C and NEMA TC3, and as recommended by conduit manufacturer.
- 7. 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.
- 8. Surface Metal Raceway Fittings: As recommended by raceway manufacturer.
- 9. 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.
- 10. Rigid Aluminum Fittings:
  - a. Provide malleable iron, steel or aluminum alloy materials; zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
  - b. Locknuts and Bushings: As specified for rigid steel and IMC conduit.
  - c. Set Screw Fittings: Not permitted for use with aluminum conduit.
  - d. Indent type connectors or couplings are prohibited.
  - e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are not permitted.
  - f. Provide OEM approved fittings.
- 11. 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.
- 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-0 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.
  2. 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.

**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
Distributed Radio Antenna Equipment and System	27 53 19	Conduit to Cable Tray, Partitioned Cable Tray

- B. Penetrations:

1. Cutting or Holes:

- a. Locate holes in advance of installation. Where they are proposed in structural sections, obtain approval of structural engineer and COR prior to drilling through structural sections.
  - b. Make holes through concrete and masonry in existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not permitted; COR 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 19 mm (3/4 inch), but not less than size required for 40 percent fill.
  2. Install insulated bushings on all conduit ends.
  3. Install pull boxes after every 180 degrees of bends (two 90 degree bends). Size boxes per TIA 569.
  4. Extend vertical conduits/sleeves through floors minimum 75 mm (3 inches) above floor and minimum 75 mm (3 inches) below ceiling of floor below.
  5. Terminate conduit runs to and from a backboard in a closet or interstitial space at top or bottom of backboard. Install conduits to enter telecommunication rooms next to wall and flush with backboard.
  6. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections.

7. Seal empty conduits located in telecommunications rooms or on backboards with a standard non-hardening putty compound to prevent entrance of moisture and gases and to meet fire resistance requirements.

8. Minimum radius of communication conduit bends:

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
3/4	150 (6)
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

9. Provide 19 mm (3/4 inch) thick fire retardant plywood specified in Section 06 10 00, ROUGH CARPENTRY on wall of communication closets where shown on drawings. Mount plywood with bottom edge 300 mm (12 inches) above finished floor and top edge 2.74 m (9 feet) A.F.F.
10. Provide pull wire in all empty conduits; sleeves through floor are exceptions.
11. Complete each entire conduit run installation before pulling in cables.
12. Flattened, dented, or deformed conduit is not permitted.
13. Ensure conduit installation does not encroach into ceiling height head room, walkways, or doorways.
14. Cut conduit square with a hacksaw, ream, remove burrs, and draw tight.
15. Install conduit mechanically continuous.
16. 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).
17. Support conduit within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.

18. Close ends of empty conduit with plugs or caps to prevent entry of debris, until cables are pulled in.
  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:
- E. Furred or Suspended Ceilings and in Walls:
1. Rigid steel, or rigid aluminum. 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 or rigid aluminum.
    - 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. 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.
- 4.

H. Conduit Supports, Installation:

- 1. Select AC193 code listed mechanical anchors or fastening devices with safe working load not to exceed 1/4 of proof test load.
- 2. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.
- 3. Support multiple conduit runs with trapeze hangers. Use trapeze hangers designed to support a load equal or greater than sum of the weights of the conduits, wires, hanger itself, and 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.
- I. Box Installation:
1. Boxes for Concealed Conduits:
    - a. Flush mounted.
    - b. Provide raised covers for boxes to suit wall or ceiling, construction and finish.
  2. In addition to boxes shown, install additional boxes where needed to prevent damage to cables during pulling.
  3. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
  4. Stencil or install phenolic nameplates on covers of boxes identified on riser diagrams; for example "SIG-FA JB No. 1".
  5. Outlet boxes mounted back-to-back in same wall are not permitted. A minimum 600 mm (24 inches) center-to-center lateral spacing must be maintained between boxes.
- J. 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 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.

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**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.

**1.2 RELATED WORK**

- A. Sealing around penetrations to maintain integrity of time rated construction: Section 07 84 00, FIRESTOPPING.
- B. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
- C. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.
- 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. 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 will 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. Power: Provide specific voltage, amperage, phases, and quantities of circuits.
- E. Provide conduit size requirements.
- F. 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, etc.): 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, etc., 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, etc. 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 6.
  - 2) IDC punch blocks (with internal RJ45 jacks) are acceptable for use in CCS when designed for Category 6 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, etc. 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 6 for specialized powered systems accepted by SMCS 0050P2H3, (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.

### **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. 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, control, etc.); 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 must be tied at minimum 460 mm (18 inches) intervals to a solid building structure; bundled wires or cables must 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, etc. is not permitted.
12. Wires or cables installed outside of conduit, cable trays, wireways, cable duct, etc.:
  - 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.

C. 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, crosstalk, etc. 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 printers thermal ink transfer process; handwritten labels are not acceptable.
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<sup>-6</sup> 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, etc.) in these records as change occurs.
- E. Test cables after installation and replace any defective cables.

- - - E N D - - -

## SECTION 27 53 19

## DISTRIBUTED RADIO ANTENNA (WITHIN BUILDING) EQUIPMENT AND SYSTEM

## PART 1 - GENERAL

- A. Pursuant to the Department of Veterans Affairs (VA), General Council's (GC) Decision (FY1998 and Grand-Fathered to be fully implemented in FY2000) directing VA that all VOICE (aka TELEPHONE) and DATA (aka DIGITAL) Low Voltage Communications Wires and Cables have been "DECLARED AS BUILDING FIXTURES;" AND are to be provided as a part of the BUILDING STRUCTURE Installed During Construction by Construction and Facilities Management's (CFM) AND each Facility's (VAMC, OPC, CBOPC, etc.) Construction / Renovation Projects.
- B. **VA** - IS REQUIRED TO INSTALL AND MAINTAIN A STRUCTURED AND FULLY FUNCTIONING COMMUNICATIONS WIRE, CABLE AND SIGNAL DISTRIBUTION TIP CONTAINING ALL LOW VOLTAGE COMMUNICATIONS SYSTEMS, EQUIPMENT, PATHWAY(S), DISTRIBUTION AND INTERFACE POINT[S] THAT RENDERS A FULLY FUNCTIONING TIP FOR EACH VA FACILITY THROUGHOUT ITS MEDICAL CARE NETWORK.
- C. THIS DOCUMENT FORMS BUT ONE (1) PART OF CFM'S REQUIRED FOUR (4) PART TIP TECHNICAL SPECIFICATION REQUIREMENTS REQUIEMENTS OUTLINED HEREIN AND IN SECTIONS: 27 10 00 - COMMUNICATIONS ROOMS FITTINGS (that included all Outside and In-side TIP Conduit Systems and Equipment;
- D. ADDITONALLY, THIS DOCUMENT CONTAINS COMMON REFERENCE(S) ADDRESSING ALL DIVISION 27 SECTIONS AND IS TO BE INCLUDED AS THE BASIC PART OF EACH LOW VOLTAGE SYSTEM'S CONTRACT DOCUMENTS. EACH DIVISION 27 SECTION WILL REFER BACK TO THE APPROPRIATE PARAGRAPH(S) HEREIN IN-LIEU OF REPEATING THE SAME INFORMATION AND WRITING OVER AN OVER. THE SPEC WRITER IS CAUTIONED TO *INSURE* EACH APPROPRIATE DIVISION 27 SECTION IS MADE A PART OF THE CONTRACT PACKAGE WHERE THIS DOCUMENT FORMS THE BASIS FOR ALL (re PART 1.1 STATEMENT). THEREFORE, IN ADDITION TO THE REQUIREMENTS OF SECTION 01 42 19-REFERENCE STANDARDS, THESE DOCUMENTS AND THE INFORMATION DEPICTED HEREIN SHALL BE THE MINIMUM STANDARD(S), CODES AND REQUIREMENTS FOR EACH DIVISION 27 COMMUNICAITONS SYSTEM SO IDENTIFIED (re PART 1, PARAGRAPH 1.3.A.1 for VA HEADQUARTERS [aka VACO], and other required project contact information DO NOT DELETE)

## 1.1 DESCRIPTION

- A. This Section describes the interfacing, technical and performance requirements for a fully installed, functioning and operating Distributed RF Antenna (Within House) Equipment and System (hereinafter will be referred to as "the system"). The system is based upon outside antenna(s), inside plant, active amplification

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functions and architecture to support local two way communications for Public Safety Radio (aka Emergency Responder, local and state police, sheriff, ambulance, etc) Radio Coverage via IWS architecture for the Cincinnati VA Main Hospital Facility (Building 1) Floors Pipe Basement through third. The Contractor:

- B. SHALL USE ALL SECTIONS IDENTIFIED IN PART 1, PARAGRAPH 1.2 THAT HAVE BEEN DETERMINED, BY VA, NECESSARY FOR THE COMPLETE SYSTEM PROJECT(S), TO THE EXTENT THAT IS DESCRIBED HEREIN AND IN EACH SECTION, IN ORDER TO PROVIDE THE VA FACILITY A STATE-OF-THE-ART, VIABLE, COMPLETE AND FULLY FUNCTIONAL REQUIRED LOW VOLTAGE COMMUNICATIONS SYSTEM(S).
1. IF A REFERENCED SECTION APPEARS NOT NEEDED, THE CONTRACTOR SHALL NOTIFY THE COR, IN WRITING, OF EXACTLY WHY HE/SHE FEELS THAT PARTICULAR SECTION APPEARS NOT NECESSARY,
  2. THE COR, IN TURN, WILL RESEARCH THE ISSUE AND CONTACT VA'S SMCS (0050P2H3a) FOR AN OFFICIAL TECHNICAL DETERMINATION AND WILL REPLY TO THE CONTRACTOR, IN WRITING, OF THE OFFICIAL CONTRACT DECISION CONCERNING THE REQUEST AFFECTING THE PROJECT, and
  3. Is cautioned to obtain, in writing, all approvals for system changes (ie corrections, updates, additions, subtractions, etc.) relating to the published bid contract specifications, drawings and other approved contract document(s), from CFM'S COR BEFORE proceeding with the change.
- C. The voice (telephone) and data portion of the horizontal TIP is managed by VA and/or the Facility's OI&T. The FMS (low-voltage special communications) portion of the TIP is managed by the Facility's FMS with technical assistance provided by VA OI&T's SMCS 0050P2H3.
- D. The system Contractor shall provide all system design, project management, coordination with WSPs and Public Safety, Radio Enhancement / Emergency Responder Services, and with VAMC Entities (ie Police, FMS, OI&T (local for wireless LAN/VoIP) and VACO Spectrum Management (SMCS 0050P2H3B) for technical and RF authorization compliance).
- E. The DAS is designated by VA as an "Emergency and Public Safety" Communications System. THE DAS shall be an International Fire Code (IFC) compliant Emergency Responder Radio Coverage System (ERRCS).

## 1.2 RELATED WORK

- A. (re PART 1, PARAGRAPH 1.1.): In addition to the requirements identified in SECTION 01 00 01, GENERAL CONDITIONS; the following SECTIONS, that are not bracketed ARE THE MINIMUM REQUIRED FOR ALL SYSTEMS(S). The bracketed SECTIONS

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MAY - ALL, PART OR NONE be required to form a complete and functioning system depending system design, present and approved future requirements.

- B. In the event of conflict or discrepancy between this Section and the requirements of the PSRAS Code, the requirements stated herein for PSRAS shall govern unless the local PSRAS requirement is more stringent and is furthermore not contrary to the National Requirements for PSRAS.
- C. The Contractor shall identify the portion(s) of this Section that has exceeded the requirements and receive approval from the AHJ and COR for acceptance. The following SECTIONS are the minimum required,
1. 00 01 15 - List of Drawing Sheets.
  2. 01 00 01 - General Conditions.
  3. 01 33 23 - Shop Drawings, Product Data and Samples.
  4. 01 42 19 - Reference Standards.
  5. 01 74 19 - Waste Management.
  6. 07 84 00 - Firestopping.
  7. 26 05 11 - Requirements for Electrical Installations.
  8. 26 05 26 - Grounding and Bonding for Electrical Systems.
  9. 26 05 33 - Raceways and Boxes for Electrical Systems.
  10. 27 05 11 - Requirements for Communications Installations.
  11. 27 05 26 - Grounding and Bonding for Communications Systems.
  12. 27 05 33 - Raceways, Conduits and Boxes for Communications Systems.
- C. The following information is in addition to those identified herein: AHJ Ordinance and / or Supplemental Rules for Public Safety Radio Enhancement / Emergency Responder Amplification Systems.

### 1.3 DEFINITIONS

- A. In addition to the requirements of SECTION 01 00 01, GENERAL CONDITIONS; the following are made a part of this document:
- B. REVIEW OF CONTRACT DOCUMENTS - a service by the CFM AE, PM, COR AND VACO SMCS to reduce the possibility of materials being ordered which do not comply with contract documents. The review shall not relieve the Contractor of responsibility for dimensions or compliance with the contract documents. The reviewer's failure to detect an error does not constitute VA's permission for the Contractor to proceed in or with the error.
1. VA Headquarters (aka VACO) Project Review: Is required for National and Local Building Codes, Standards and Guidelines Compliance, contact:
    - a. COR: CFM, Contracting Officer (may be intermixed with the Facility's CO), and

- b. AE: CFM's, Contracted Project's Architectural Engineering Firm.
- 2. VACO Technical Review: Is required for VA Security; Low Voltage Telecommunications, RF, FAA, FCC and other Spectrum Coordination, Licensing and operating permits; Life and Public Safety, Critical and Emergency Codes, Standards and Guideline Compliance; AND, System(s) Interim and Proof of Performance Testing, VA Final Technical Acceptance, Functional and Operational Certification, contact:
  - a. VACO: Department of Veterans Affairs Office of Telecommunications (005) Telecommunications Engineering (005OP) Spectrum Management and COMSEC Service Special Communications Team (005OP2H3a)  
810 Vermont Avenue NW, (1100 1st NW, Area 501L) Washington, DC 20420  
301-734-0376, 202, 632, 7754 or 202-461-5897
  - b. VACO, OFFICE OF TELECOMMUNICATIONS, ENTERPRISE ENGINEERING, SPECTRUM MANAGEMENT AND COMMUNICATIONS SECURITY (COMSEC) SERVICE (SMCS) IS THE AUTHORITY HAVING JURISDICTION (AHJ - see SME PART 1, PARAGRAPHS 1.3.A.2, 1.3.B.41) FOR THE LOW VOLTAGE SPECIAL COMMUNICATIONS AND COMSEC SYSTEMS AND EQUIPMENT (EXCEPT FIRE ALARM, Telephone and Data); PLUS, RF CO-ORDINATION REQUIRED THROUGH-OUT VA'S MEDICAL SYSTEM BY ORDER OF THE SECRETARY (RE PART 1, PARAGRAPH 1.4.B.1.a.(7)(a): VICE THE SIGNED AND EXECUTED MP-6, PART VIII - TELECOMMUNICATIONS, CHAPTER 5-AUDIO, RADIO AND TELEVISION COMMUNICATIONS SYSTEMS.
    - 1) For each of the DIVISION 27 Publication referred and used here-in, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should and will" where it appears.
    - 2) Interpret references in these publications to the "AHJ," or words of similar value, to mean the CFM: PM, or COR for Project / Contract Guidance; AND VACO SMCS for Technical Concurrence.
- 3. Construction Responsible Entities: The following firms / individuals form the Project / Contract's primary core for the building / construction:
  - a. PC: Prime Contractor (aka General Contractor),
  - b. System Contractor: The Contractor; you - the successful bidder,
  - c. OEM: The Systems' "Original Equipment Manufacturer,"
  - d. Project Engineer(s): Heapy Engineering  
James Krile Lead Designer,  
Don Engle Project Manager.
- B. **THE FOLLOWING ACRONYMS** are made a part of this document and are in addition to the ones aforementioned and later herein:



1. AHJ - Authority Having Jurisdiction - SMCS (0050P2H3) for Low Voltage Telecommunications Systems (Re PART 1, PARAGRAPHS 1.3.A.2.a & b; 1.4.b.1.a. (7) (a) and 1.8.A.& B,
2. AWG - American Wire Gauge (originally North American Wire Gauge; see STP & UTP) - also known as the Brown & Sharpe wire gauge, is a system used for standardizing all wire and cable conductors cross-sectional area (diameters) that has been in use since c1857 pre-dominantly in the United States and Canada,
3. AWS - Advanced Wireless Services (synonymous with AWS and UMTS),
4. BDA - Bi-Directional Amplifier,
5. BICSI - Building Industries Communications Services Installation,
6. BIM - Building Information Modeling (aka Model),
7. BOM - CFE or GFE Bill of Materials,
8. BUCR - Back-up Computer Room - (re PG 18-10, Page B-5; OI&T Design Guide PG 18-12, Page 4-4),
9. BTS - Base Transceiver Station,
10. CFE - Contractor (or OEM) Furnished Equipment,
11. CFR - Consolidated Federal Regulations - that governs ALL Federal Contracts / Projects.
12. CUP - Conditional Use Permit(s)-Federal/GSA for VA,
13. DBm - Deci-Bell, Measured.
14. DBmV - Deci-Bell per Mili-Volt,
15. ECC - Engineering Control Center; sometimes referred to The Emergency Control Center, - (see EMCR, re PG 18-10, Page B-5),
16. EMCR - Emergency Management Control Room" - (see ECC, re PG 18-10, Page B-5),
17. EMI - Electromagnetic Interference - also called Radio Frequency Interference or RFI when a high frequency (or radio frequency) disturbance affects an electrical circuit due to either electromagnetic induction or electro-magnetic radiation emitted from an external source (see ESI, RFI),
18. EMT - Electrical Metallic Tubing - relates to "thin wall" non-rigid metal conduit,
19. ENTR - Utilities Entrance Location (see DEMARC, POTS, LEC)" - (re PG 18-10, Page B-5),
20. ESI - Electrostatic Interference - also called "Electro-static Discharge Interference (ESD) - ESD is the transfer of static charge between

bodies of different electrostatic potential, in the proximity or through direct contact (see EMI, RFI),

21. ESR - Vendor Engineering Service Report,
22. ERTF - Real Time Location System,
23. FA - Fire Alarm - is a system that is installed in VA Facilities to protect the building and installed property,
24. GFE - Government Furnished Equipment,"
25. HE - Antenna Head End Room - (re PG 18-10, Page B-5; OI&T De-sign Guide PG 18-12, Page 4-76; see HEC, HEIC, PA, RPEC),
26. HEC - Head End Cabinet(s) - (re PG 18-10, Page B-5; OI&T De-sign Guide PG 18-12, Page 4-76; see HE, HEIC, PA, RPEC),
27. HEIC - Head End Interface Cabinet(s) - (re PG 18-10, Page B-5; OI&T Design Guide PG 18-12, Page 4-76; see HE, HEC, PA RPEC),
28. HSPA - High Speed Packet Access,
29. iDEN - Integrated Digital Enhanced Network,
30. ICRA - Infection Control Risk Assessment,
31. ILSM - Interim Life Safety Measures,
32. ISM - Industrial, Scientific, Medical,
33. LAN - Local Area Network (see VoIP, WAN) - is a digital / data based network localized within a given structure (VA'S LAN IS NOT AUTHORIZED FOR LIFE AND PUBLIC SAFETY, CRITICAL OR EMERGENCY FUNCTIONS UNTIL IT'S CERTIFIED AND LISTED MEETING NFPA'S LIFE SAFETY CODE BY AN AP-PROVED UDOC NRTL - SEE PART 1, PARAGRAPH 1.4.B.1.a. [5]),
34. LBS - Location Based Services,
35. LEC - Local Exchange Carrier - (aka the Local Telephone Company; see DEMARC, PBX & POTS),
36. LMR - Land Mobile Radio,
37. LTE - Long Term Evolution,
38. MCR - Main Computer Room - (re PG 18-10, Page B-5, OI&T De-sign Guide PG 18-12, Pages 2-18, 4-9),
39. MCOR - Main Computer Operators Room - (re PG 18-10, Page B-5),
40. MH - Man Hole (aka Maintenance Holes) are structures used to provide access to outside buried conduit runs in or-der to allow compliance for signal interconnection, protection and long run operations across wide areas and multiple buildings/locations,
41. MOU - Memorandum of Understanding,
42. MW - Microwave (RF Band, Equipment or Services),

- 43. NID - Network Interface Device - (see DEMARC),
- 44. NEC - National Electric Code - is the main part of NFPA's Standards and Guides referenced herein,
- 45. NFPA - National Fire Protection Association - establishes minimum standards for the protection of life and buildings in VA Projects,
- 46. NOR - Network Operations Room - (re PG 18-10, Page B-5; OI&T Design Guide PG 18-12, Page 4-54),
- 47. NS - Nurse Station(s) - (re PG 18-10, Page B-5),
- 48. OI&T - VA's Office of Information and Telecommunications (re OI&T Design Guide PG 18-12, Page 2-1),
- 49. OSHA - Occupational Safety and Health Administration,
- 50. OTDR - Optical Time Domain Reflectometer relating to the primary piece of test equipment for evaluating fiberoptic cable plants,
- 51. PA - Public Address / Cabinet(s) (re PG 18-10, Page B-5; see HE, HEIC, RPEC),
- 52. PBX - Private Branch Exchange (see DEMARC, LEC, POTS; aka EPBX or Electronic Private Branch Exchange - a reference that is being phased out and will no longer be used in VA) is the typical acronym for a Telephone Switch not owned by the Telephone Company that is NFPA CRITICAL SERVICE LIST-ED AND VA APPROVED FOR THE DIRECT MANAGEMENT OF THOSE LIFE SAFETY CODE AND OSHA REQUIRED FACILITIES MANAGEMENT SERVICE'S (FMS) LIFE & PUBLIC SAFETY, CRITICAL AND EMERGENCY COMMUNICATIONS SYSTEMS (re OI&T Design Guide PG 18-12, Page 4-20),
- 53. PCR - Police Control Room (see SPCC), could be designated SCC" (re PG 18-10, Page B-5),
- 54. PCS - Personal Communications Service,
- 55. POE - Power over Ethernet,
- 56. POTS - Plain Old Telephone System (see DEMARC, LEC, PBX),
- 57. PSRAS - Public Safety Radio Amplification Systems,
- 58. PTS - Pay Telephone Station (may or may not be required); OR may be provided on as a portable station controlled by the using Service Chief (re PG 18-10, Page B-5),
- 59. PVC - Poly-Vinyl Chloride" - relates to a form of plastic,
- 60. RAN - Radio Access Network,
- 61. RFI - "Radio Frequency Interference" is the Electromagnetic Radiation which is emitted by electrical circuits carrying rapidly changing signals, as a by-product of their normal operation, and which causes unwanted

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- signals (interference or noise) to be induced in other circuits (see EMI, ESI),
62. RFID - RF Identification,
63. RPEC - Radio Paging Equipment Cabinet(s) - (see HE, HEC, HEIC, PA; PG 18-10, Page B-5),
64. RUS - The DoA's - "Rural Utilities Service" which is technical standards issued (for telecommunications services here-in). Also, RUS BULL is "Rural Utilities Service Bulletin" applied for the aforementioned telecom service,
65. RSSI - Mobile Telecommunications System,
66. RTLS - Real Time Location Service / System,
68. SME - Subject Matter Expert - (re, PART 1-GENERAL, PARA-GRAPHS 1.3.A.2 and 1.4.B.1.a. - VACO SMCS as AJS),
69. SMR - Specialized Mobile Radio,
70. STP - Shielded Twisted Pair (see AWG & UTP)- relating to communications wire and cable that has copper conductors that are twisted to reduce or eliminate interference and crosstalk with an internal cable shield necessary for installation in locations susceptible to high levels of interference,
71. STR - Stacked Telecommunications Rooms; also just Telecommunications Room (see TR)" - this term replaces "Signal and/or Telecommunications Closet" that are no longer used. Additionally, each TR shall be designed to provide occupancy for all OI&T AND FMS Low Voltage Communications Systems/Equipment (re Electrical Design Manual, PG 18-10, Sections 7 & 8, Physical Security Design Manual for VA Facilities, PG 18-10 AND OI&T Design Guide PG 18-12, Pages 2-20 & 4-84),
72. TCO - Telecommunications Outlet - is a device that is specifically constructed to afford the TIP a place to terminate in a useable apparatus in designated locations. The TCO's design is detailed herein,
73. TOR - Telephone Operators Room - (re PG 18-10, Page B-5; OI&T Design Guide PG 18-12, Page 4-92),
74. TER - Telephone Equipment Room - (see PBX; re PG 18-10, Page B-5; OI&T Design Guide PG 18-12, Page 4-50),
75. TR - Telecommunications Room - is a standalone room that houses OI & T and FMS equipment and systems cross-connections for servicing a specific area (see STR),
76. UMTS - Universal Mobile Telecommunications System,

77. UPCS - Unlicensed Personal Communications Service
78. UL - Underwriters Laboratories - is one of the approximate 15 USDC approved NRTLs (see PART 1, PARAGRAPH 1.4.B.1.a. [5]),
79. UTP - Unshielded Twisted Pair (see AWG & TWP) - relates to communication wire and cable that has copper conductors and are twisted to reduce or eliminate interference and cross-talk without an internal cable shield,
80. UV - Ultra Violet,
81. VoIP - Voice over Internet Protocol (see PBX, LAN, WAN) - is an emerging technology that is replacing POTS & PBX voice equipment (VA'S VoIP IS NOT AUTHORIZED FOR LIFE & PUBLIC SAFETY, CRITICAL, EMERGENCY OR SAFETY FUNCTIONS UNTIL IT'S CERTIFIED AND LISTED MEETING NFPA'S LIFE SAFETY CODE BY AN APPROVED UDOC NRTL - SEE PART 1, PARAGRAPH 1.4.C.1.e.; OI&T Design Guide PG 18-12, Page 4-14),
82. WAN - "Wide Area Network (see LAN, VoIP)" is a digital (data) network that transcends localized LANs within a given structure (VA'S WAN IS NOT AUTHORIZED FOR LIFE & PUBLIC SAFETY, EMERGENCY OR SAFETY FUNCTIONS UNTIL IT'S CERTIFIED AND LISTED MEETING NFPA'S LIFE SAFETY CODE BY AN APPROVED UDOC NRTL - SEE PART 1, PARAGRAPH 1.4.C.1.e; see LAN),
83. Wi-Fi - Wireless Fidelity,
84. WiMAX - Worldwide Interoperability for Microwave Access,
85. WMTS - Wireless medical Telemetry Service, and
86. 24/7 - Is the shortened designation of 24 hours a day, seven days per week and 52 weeks per year.

C. **ADDITIONALLY:** The following language is required to form a part of this document (re SECTION 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS for additional required information). The terms:

1. Provide is considered as being: Designed, engineered, furnished, installed, tested and guaranteed by the Contractor AND the system equipment's OEM; plus, being concurred and certified by SMCS-0050P2H3,
2. Supervision:

a. <u>Electrical</u>	Is the electrical and/or electronic operation of completely (aka full time) analyzing a system's functional components (ie cable breaks / shorts), in-operative stations, lights and state(s) of change (ie from primary to backup) functions 24/7/365; <b>and</b> provides aural and visual emergency notification signals to at least two remote designated / approved monitoring stations,
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b. <u>Government</u>	It is the responsibility of the COR or the COR's assigned inspector to observe the Contractor's employees <b>installing cable, conduit &amp; pathway(s) / wire way(s), System Ground development and installation</b> , inside and outside plant housings, splices, cleanup, and other related work items associated with the system(s) construction project.
c. <u>Contractor</u>	It is the responsibility of the Contractor to directly manage the Contractor's employees work as outlined by this document throughout the system(s) project.
d. <u>OEM</u>	It is the responsibility of the OEM or the OEM's assigned liaison to assist the Contractor in all functions / requirements / operations outlined herein throughout the project.

3. System: Used interchangeably with "The System" is the common word that is applied for each SECTION's specific system in order to shorten each SECTION's written NOT TECHNICAL content,
4. Work: Materials furnished and completely installed by the Contractor. The System work shall be complete, OSHA NRTL (i.e. [UL]) - Listed AND Labeled on each item of installed equipment / part; AND VACO SMCS 0050P2H3a tested, certified and designated ready for operation (re "Work Performance," PART 1, PARAGRAPH 1.12).
5. Grounding and Bonding (re SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS):

a. <u>Grounding electrode conductor</u>	Shall refer to the earth grounding electrode that is connected to the separate circulating telecommunications grounding conductor, to the equipment grounding conductor at the source of a separately derived system.
b. <u>Grounding electrode system</u>	Refers to an electrode(s) as specified in the National Electrical Code, Article 250. All electrodes required by NEC, as well as including supplementary, telecommunications system grounding electrodes.
c. <u>Telecommunications Bonding Backbone</u>	Or " <b>TBB</b> " shall refer to a conductor(s) of appropriate size (minimum 1/0 Stranded AWG), which connects each telecommunications main grounding busbar ( <b>TMGB</b> ) and circulates to interconnect various telecommunications grounding busbars ( <b>TGB</b> ) and in the locations shown on the drawings.
d. <u>Connect and bond</u>	Are used interchangeably herein and shall mean "the permanent joining of metallic parts to form an electrically conductive path that will assure electrical continuity and the capacity to conduct safely any current likely

	to be imposed" having the same meaning.
e. <u>effectively grounded</u>	Shall mean intentionally connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current carrying capacity to prevent the buildup of voltages that may result in undue hazard to connected equipment or persons.
f. <u>Grounding equalizer</u>	Shall refer to the conductor that interconnects elements of the telecommunications grounding infrastructure.

**1.4 APPLICABLE PUBLICATIONS AND VESTED FEDERAL, STATE AND LOCAL LAWS (DO NOT DELTE):**

**A.** In addition with the requirements in SECTION 01 00 01, GENERAL CONDITIONS; the following is made a part of this document:

1. ORDER OF PRECEDENCE OF APPLYING STANDARDS AND CODES: In the case of a conflict or duplicate code or standard (re PART 1, PARAGRAPHS 1.8.A), use the following deciding guidance for:

- a. Duplicate Codes / Standards: Use the most recent Federal Code / Standard (unless the State and Local Code addresses increased specific regional safety requirements [ie roof construction in Florida, increased Seismic requirements in California, etc.]), and
- b. Conflict of Codes / Standards: Use the more stringent Code / Standard.

**B. IN ADDITION TO THE REQUIREMENTS OF SECTION 01 42 19 - REFERENCE STANDARDS (DO NOT DELTE):** The following information is made a part of the System's design and installation minimum requirements; and the installation shall fully comply with all governing authorities, laws and ordinances, regulations, and including, but not limited to UNITED STATES FEDERAL LAW and The following Agencies' requirements form a part of the System's Project Documents a directed by formal regulations vested in United States Federal Law:

**C. US Departments of Agriculture, (USDA - Title 7, USC, Chapter 55, Sections 2201, 2202 & 2202) - organized in 1862 by President Abraham Lincoln and formally established by Congress in 1820 & 1825 and final establish Law on February 9, 1889. The following USDA Standards apply to this document:**

RUS 1755 .....Telecommunications Standards and Specifications for  
 Materials, Equipment and Construction,

RUS Bull 1751F-630 .....Design of Aerial Cable Plant(s),

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 Plant(s),

RUS Bull 1753F-201 .....Acceptance Tests of Telecommunications Plant(s) (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).

- D. US Department of Commerce, (USDC - Public Law 426-62, CFR, Title 15 - Under the Information Technology Management Reform Act; Public Law 104-106, the Secretary of Commerce approves standards and guidelines that are developed by the):

National Institute of Standards Technology, (NIST - formerly the National Bureau of Standards, now P/O Commerce). Under Section 5131 of the Information Technology Management Reform Act of 1996 and the Federal Information Security Management Act of 2002 (*Public Law 107-347*), NIST develops Federal Information Processing Standards Publication (FIPS) requirements, Chapter II. The following NIST FIPS Documents forms a part of this document:

FIPS PUB 1-1 ..... Telecommunications Information Ex-change,  
 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.

- E. Federal Communications Commission, (FCC, P/O Commerce - *The Communications Act of 1934*, CFR, Title 47, Telecommunications) - the following FCC Rules / Regulations / Requirements applies to this document:

Part 15 ..... Restrictions of use for Part 15 listed RF Equipment in Safety of Life Emergency Functions and Equipment Locations (also see CFR, Title 15 - Department of Commerce, Chapter XXIII - NTIA below),



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 - aka 'Red Book') Chapters 7. 8. /  
 9; CFR, Title 47 FCC Part 15, RF Restriction of Use and  
 Compliance in "Safety of Life" Functions & Locations.

F. Department of Defense, (DoD, The National Security Act of 1947) - formed the  
 National Military Establishment; re-organized to The Department of Defense (DoD)  
 on August 10, 1949 as an Amendment to the 1947 Law. The following DoD  
 guidelines apply to this document:

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.

G. Department of Health, (HHS, Public Law 96-88, CFR, Title 42, Chapter IV Health &  
 Human Services (HHS), CFR, Title 46, Subpart 1395(a), (b) defines the Joint  
 Commission of Accreditation of Hospital Organization (JCAHO - RE PART 1,  
 PARAGRAPH 1.4.E.1) - **The Secretary of HHS has decreed "a hospital that meets  
JCAHO accreditation is deemed to meet the Medicare conditions of Participation  
 by meeting Federal Directives)" in:**

**Life Safety System References,**

**Critical Safety System References,**

**Public Safety System References,**

**Telephony System Engineering References,**

**Data / Digital Systems Engineering References,**

**Information Security References.**

H. 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). The following OSHA Standards apply to this document:

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**Subpart 7** - defines the requirements for a Nationally Recognized Testing Laboratory (**NRTL**) - for complete list, of authorized NRTLs contact their below WEB Site. The following are four (4) of the approximate 15 approved NRTLs (obtain a copy at): ([http://www.osha.gov/dts/otpc/nrtl/fag\\_nrtl.html](http://www.osha.gov/dts/otpc/nrtl/fag_nrtl.html))

UL (re Part 1, Paragraph 1.4.B.8): The following UL Standards apply to this document:

UL01 .....	Flexible Metal Conduit,
UL05 .....	Surface Metal Raceways and Fittings,
UL06 .....	Rigid Metal Conduit,
UL44 .....	Standard for Thermoset-Insulated Wires and Cables,
UL50 .....	Enclosures for Electrical Equipment,
UL65 .....	Standard for Wired Cabinets,
UL83 .....	Standard for Thermoplastic-Insulated Wires and Cables,
UL96 .....	Standard for Lightning Protection Components,
UL96A .....	Installation requirements for Lightning Protec-tion Systems,
UL360 .....	Liquid-Tight Flexible Steel Conduit,
UL444 .....	Communications Cables,
UL467 .....	Standard for Electrical Grounding and Bonding Equipment,
UL468 .....	Standard for Grounding and Bonding Equipment,
UL486A .....	Standard for Wire Connectors and Soldering Lugs for Use with Copper Conductors,
UL486C .....	Standard for Splicing Wire Connectors,
UL486D .....	Standard for Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations,
UL486E .....	Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors,
UL493 .....	Standard for Thermoplastic-Insulated Under Ground Feeder and Branch Circuit Cable,
UL497 .....	Protectors for Paired Conductor Communications Circuits,
UL497A .....	Secondary Protectors for Communications Circuits,
UL510 .....	Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape,
UL514A .....	Metallic Outlet Boxes,
UL514B .....	Standard for Fittings for Cable and Conduit,
UL514C .....	Non-Metallic Outlet Boxes, Flush Devices and Covers,
UL651 .....	Schedule 40 and 80 Rigid PVC Conduit,

UL797 ..... EMT,  
 UL884 ..... Under Floor Raceways and Fittings,  
 UL1069 ..... Hospital Signaling and Nurse Call Equipment,  
 UL1198 ..... Distress Signaling.  
 UL1242 ..... Intermediate Metal Conduit,  
 UL1333 ..... Riser Low Smoke Vertical Rating,  
 UL1449 ..... Standard for Transient Voltage Surge Suppressors,  
 UL1459 ..... Standard for Safety, Telephone Equipment,  
 UL1479 ..... Standard for Fire Tests of Through-Penetration Fire  
    Stops,  
 UL1666 ..... Standard for Wire/Cable Vertical (Riser) Tray Flame  
    Tests,  
 UL1685 ..... Vertical Tray Fire Protection and Smoke Re-lease Test  
    for Electrical and Fiber Optic Cables,  
 UL1861 ..... Communication Circuit Accessories,  
 UL1863 ..... Standard for Safety, communications Circuits  
    Accessories,  
 UL1865 ..... Standard for Safety for Vertical-Tray Fire Protection  
    and Smoke-Release Test for Electrical and Optical-Fiber  
    Cables,  
 UL2024 ..... Standard for Optical Fiber Raceways,  
 UL2196 ..... Standard for Test of Fire Resistive Cable,  
 UL60950-1/2 ..... Standard for Safety of Information Technology Equipment  
    Safety.

Canadian Standards Association, (CSA - same tests as presented by UL),  
Communications Certifications Laboratory, (CCL - same tests as presented by UL),  
Intertek Testing Services NA, Inc., (ITSNA - formerly Edison Testing  
 Laboratory [ETL] - same tests as presented by UL),  
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.

- I. Department of Transportation, (DoT, Public Law 85-625, CFR, Title 49, Part 1,  
 Subpart C - Federal Aviation Administration [FAA]) - the following FAA  
 requirements form a part of this document:  
 AC 110/460-ID & AC 707 / 460-2E - Advisory Circulars Standards for Construction  
 of Antenna Towers,

7450 and 7460-2 - Antenna Construction Registration Forms.

Federal Specifications for Signal / Communications Standards (FED SPEC) - the following FED SPECS forms a part of this document:

A-A-59544-00 ..... Cable and Wire, Electrical (Power, Fixed Installation),  
1003 ..... Synchronous Bit Oriented Data Link Control Procedures,  
1020 ..... Electrical Characteristics of Balanced Voltage Digital  
Interface Circuits,  
1030 ..... Electrical Characteristics of Un-Balanced Voltage  
Digital Interface Circuits, and  
1037 ..... Glossary of Telecommunications Terms.

J. Department of Veterans Affairs (USDVA or VA, Public Law No. 100-527), CFR, Title 38, Volumes I & II) - the following VA requirements form a part of this document:

OFFICE OF TELECOMMUNICATIONS, MP-6, PART VIII, TELECOMMUNICATIONS, CHAPTER 5, AUDIO, RADIO AND TELEVISION (and COMSEC) COMMUNICATIONS SYSTEMS (RE PART 1, PARAGRAPH B):

Spectrum Management and COMSEC Service (SMCS):

FAA, FCC, & NTIA RF Compliance and Licensing Program,

COMSEC co-ordination and control of security / classified communication assets, CoG, "Continuance of Government" communications guidelines and compliance, COOP, "Continuance of Operations" emergency communications guidelines and compliance,

Wireless and Handheld Device(s) guidelines and compliance,

SATCOM - "Satellite Communications" guidelines and compliance,

Low Voltage Special Communications - Construction Contract Specifications and Drawings Conformity, Proof of Performance Testing, VACO Compliance and Life Safety Certification(s) for CFM and VA Facility Low Voltage Special Communications Projects (EXCEPT Fire Alarm, Telephone and Data Systems).

Handbook 6100 - Telecommunications: - Cyber and Information Security (OCIS), Handbook 6500 - Information Security Program.

VA's National Center for Patient Safety - Veterans Health Administration Warning System, Failure of Medical Alarm Systems using Paging Technology to Notify Clinical Staff, July 2004.

VA's Center for Engineering Occupational Safety and Health, concurrence with warning identified in VA Directive 7700.

OFFICE OF CFM:

PG-18-1, Master Construction Specifications (See Paragraph 1.1.2),

PG-18-4, Standard Detail and CAD Standards

PG-18-5, Equipment Guide List

PG-18-10, Manuals by Discipline

Electrical Design Manual,

Physical Security, Mission Critical Facilities

Physical Security, Life-Safety Protected,

VA Directive 0730, Security and Law Enforcement,

PG-18-3, .Design and Construction Production Procedures

Fire Protection,

Heating, Air, Ventilation and Cooling (HAVC),

PG-18-12, OI&T Design Guide

Additional CFM Design Guides & Manuals (re Part 1, Paragraph 1.2),

PG-18-15, Minimum Requirements of A/E Submissions:

Volume B - Major New Facilities, Major Additions; and Major Renovations, Article VI, Paragraph B,

Volume C - Minor and NRM Projects, Article III, Paragraph S,

Volume E - Request for Proposals Design/Build Projects, Article II, Paragraph F, Solicitation for Offerors (SFO) for Lease Based Clinics (05-2009).

K. Local and Regional Codes (LRC): The following Regional requirements form a part of the System's Project Documents as directed by each formal regulation(s) vested in State, City /Town Local Law and Jurisdictional Code(s) / Regulations (re PART 1, PARA-GRAPHS 1.4.A,E, 1.6 & 1.8.A). The following LRC's apply to this document:

State:

Law,

Hospital Code(s),

Regulations,

Directives,

Codes,

Town:

Ordinances,

Regulations,

Codes,

City:

Ordinances,

Regulations,

Codes,

Ordinances,  
Regulations,  
Codes.

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TIA-492CAAA ..... Detail Specification for Class IVa Dispersion- Unshifted  
Single-Mode Optical Fibers,

TIA-492E000 ..... Sectional Specification for Class IVd Nonzero-  
Dispersion Single-Mode Optical Fibers for the 1,550 nM  
Window,

EIA/TIA 496A ..... Interface between Data Circuit Terminating Equipment and  
the Public Switched Telephone Network,

TIA 526-7 ..... Measurement of Optical Power Loss of Installed Single  
Mode Fiber Cable Plant,

EIA 526-14 ..... Optical Power Loss Measurements of Installed Multimode  
Fiber Cable Plant,

EIA 530 ..... High Speed 25 Position interface for Data Terminal  
Equipment and Data Circuit Terminating Equipment,

TIA 562 ..... Electrical Characteristics for an Unbalanced Digital  
Interface,

TIA 568/0 ..... Standard for Installing Commercial Building  
Telecommunications Cabling,

TIA 568/2 ..... Commercial Building Telecommunications Cabling Standard,  
Part 2: Balanced Twisted Pair Cable Components,

TIA 568-C0 ..... Telecommunications Cabling for Customer Premises,

TIA 568-C1 ..... Commercial Building Telecommunications Cabling Standard,

TIA 568-C2 ..... Balanced Twisted-Pair Telecommunications Cab-ling and  
Components Standards,

TIA 568-C3 ..... Optical Fiber Cabling Components Standard,

TIA 569-A ..... Commercial Building Standard for Telecommunications  
Pathways and Spaces,

TIA 569-B ..... Commercial Building Standard for Telecommunications  
Pathways and Spaces,

TIA 569-B.1 ..... Part 1, General Requirements, Commercial Building  
Telecommunications Cabling,

TIA 574-9 ..... Position Non-Synchronous Interface between Data Terminal  
equipment and Data Circuit Terminating Equipment  
Employing Serial Binary Interchange,

TIA-590 ..... Standard for Physical Location and Protection of Below  
Ground Fiber Optic Cable Plant,

TIA 606A ..... Administration Standard for the Telecommunications  
Infrastructure of Communications Buildings,

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TIA J-STD-607 ..... Commercial Building Grounding (Earthing) and Bonding  
Requirements for Telecommunications,

EIA 613 ..... High Speed Serial Interface for Data Terminal Equipment  
and Data Circuit Terminal Equipment,

TIA 668-527 ..... Wireless Features Description,

TIA 758 ..... Customer Owned Outside Plant Telecommunications  
Infrastructure Standard,

TIA 942 ..... Telecommunications Infrastructure Standard for Data  
Centers,

TIA 1152 ..... Requirements for Field Testing Instruments and  
Measurements for Balanced Twisted Pair Cabling,

TIA 1179 ..... Healthcare Facility Telecommunications Infrastructure  
Standard,

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.

American Society of Mechanical Engineers (ASME) - the following ASME Standards  
apply to this document:

Standard 17.4 ..... Guide for Emergency Personnel,

Standard 17.5 ..... Elevator & Escalator Equipment (prohibited of installing  
non-elevator equipment in Elevator Equipment Room /  
Mechanical Penthouse).

American Society of Testing Material (ASTM) - the following ASTM Standards apply  
to this document:

B1 ..... Standard Specification for Hard Drawn Copper Wire,

B8 ..... Standard Specification for Concentric-Lay-Stranded  
Copper Conductors, Hard, Medium Hard, or Soft,

B258 ..... Standard Specification for Standard Nominal Diameters  
and Cross-Sectional Areas AWG Sizes of Round Wires Used  
as Electrical Conductors,

D709 ..... Laminated Thermosetting Materials,

D1557 ..... Standard Test Methods for Laboratory Compaction  
Characteristics of Soil Using Modified Effort (56,000  
ft-lbf/ft<sup>3</sup>) (2700 kN-m/m<sup>3</sup>),

D2301 ..... Standard Specification for Vinyl Chloride Plastic  
Pressure Sensitive Electrical Insulating Tape,



D4566 ..... Standard Test Methods for Electrical Performance  
Properties of Insulation and Jackets for  
Telecommunications Wire and Cable.

American Telephone and Telegraph Corporation (AT&T)- the following AT&T  
Publications apply to this document (copies may be obtained at  
<https://ebiznet.sbc.com/SBCNEBS/>):

ATT-TP-76200 ..... Network Equipment and Power Grounding, Environmental,  
and Physical Design Requirements,  
ATT-TP-76305 ..... Common Systems Cable and Wire Installation and Removal  
Requirements - Cable Racks and Raceways,  
ATT-TP-76300 ..... AT&T Installation Requirements (and ICRN's Change  
Notices),  
ATT-TP-76306 ..... Electrostatic Discharge Control,  
ATT-TP-76400 ..... Detail Engineering Requirement (and ICRN's Change  
Notices),  
ATT-TP-76402 ..... AT&T Raised Access Floor Engineering and Installation  
Requirements,  
ATT-TP-76405 ..... Technical Requirements for Supplemental Cooling Systems  
in Network Equipment Environments,  
ATT-TP-76416 ..... Grounding and Bonding Requirements for Network  
Facilities,  
ATT-TP-76440 ..... Ethernet Copper Cable & Ethernet Copper Assembly  
Specification,  
ATT-TP-76450 ..... Common Systems Equipment Interconnection Standards for  
the AT&T Local Exchange Companies and AT&T Corporation,  
ATT-TP-76461 ..... Fiber Optic Cleaning,  
ATT-TP-76900 ..... AT&T Installation Testing Requirement,  
ATT-TP-76911 ..... AT&T LEC Technical Publication Notice,  
ATT-812-000-705 ..... Technical Requirements for Thermal Management Systems in  
Network Equipment Environments.

(NOTE: SMCS-0050P2H3a - will evaluate contractor considered and produced equal  
document(s) to the aforementioned AT&T Commercial Publications, on a case-by-  
case basis as long as each supplied document is complete and on the originator  
(not the contractor or OEM) letterhead and enclosed in its published technical  
binder.

Building Industries Communications Services Installation (BICSI) - the following  
BICSI Standards apply to this document:

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All standards for smart building wiring, connections and devices for commercial and medical facilities,

Standards for Structured Building Cable Topologies,

Standards in consort with ANSI/EIA/TIA.

Institute of Electrical and Electronics Engineers (IEEE) - the following IEEE Standards apply to this document:

C62.41 ..... Surge Voltages in Low Voltage AC Power Circuits

SO/TR 21730 ..... Use of mobile wireless communication and computing technology in healthcare facilities, Recommendations for electromagnetic compatibility (management of unintentional electromagnetic interference) with medical devices,

81-1983 ..... IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Ground System,

100 ..... The Authoritative Dictionary of IEEE Standards and Terms,

0739-5175 ..... Medical Grade, Mission Critical and Wireless Networks,

1100 ..... Powering and Grounding Sensitive Electronic Equipment.

Insulated Cable Engineers Association (ICEA) - the following ICEA Standards apply to this document:

S-87-640 ..... Optical Fiber Outside Plant Communications Cable,

S-98-688 ..... Broadband Twisted Pair Telecommunication Cable, Aircore, Polyolefin Insulated, Copper Conductors Technical Requirements,

S-99-689 ..... Broadband Twisted Pair Telecommunication Cable Filled, Polyolefin Insulated, Copper Conductors Technical Requirements.

National Electrical Manufacturers Association (NEMA) - the following NEMA Standards form a part of this document:

C62.61 ..... American National Standard for Gas Tube Surge Arresters on Wire Line Telephone Circuit,

FB-1 ..... Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Metallic Tubing and Cable,

OS-1 ..... Sheet Steel Outlet Boxes, Device Boxes, Covers and Box Supports,

TC-3PVC Fittings for Use with Rigid PVC Conduit and Tubing.

NFPA - the following NFPA Standards apply to this document:

- 69 ..... National Electrical Safety Code (NES, current date of issue),
- 70 ..... NEC (current date of issue); Articles 300, 517, 645, 700 & 800,
- 72 ..... National Fire Alarm and Signaling Code,
- 75 ..... Standard for Protection of Electronic Computer Data Processing Equipment,
- 76 ..... Standard for the Fire Protection of Telecommunications Facilities,
- 77 ..... Recommended Practice on Static Electricity,
- 99 ..... Healthcare Facilities,
- 101 ..... Life Safety Code,
- 1221 ..... Emergency Communications Systems.

The Society for Protective Coatings (SSPC) - the following SSPC Standard apply to this document: SSPC SP 6/NACE No.3 - Commercial Blast Cleaning.

International Telecommunication Union (ITU) - the following ITU Standard applies to this document: Telecommunication Standardization Sector (ITU-T).

#### 1.5 QUALIFICATIONS (OEM AND SERVICES)

- A. MANUFACTURERS (refer to SECTION 2, PARAGRAPH 2.3): The OEM shall have had experience with three (3) or more installations of systems of comparable size and interfacing complexity with regards to type and design as specified herein. Each of these installations shall have performed satisfactorily for at least two (2) years in seriatim after final acceptance by the user. Include the names, locations and point of contact for these installations as a part of the technical submittal (see PART 1, PARAGRAPH 1.8).
- 1. The Contractor shall submit certified documentation they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years; the:
  - b. Contractor shall provide OEM certification they are authorized to pass thru the OEM's warranty of the installed equipment to VA,
  - c. OEM and Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the System.
- 2. The Contractor's Communications Engineers and Technicians as-signed to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the System. The

Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the technical submittal (see PART 1, PARAGRAPH 1.8). VA will not approve technical submittals without this information.

3. The OEM shall ensure that all management, sales, engineering and installation personnel have read and understand the requirements of this document before the system is provided. The Contractor shall furnish a written statement attesting this requirement as a part of the technical submittal (see PART 1, PARAGRAPH 1.8) that includes each name and certification, including the OEMs. VA will not approve technical submittals without this information.

#### B. SERVICES

1. The System will be delivered free of engineering, manufacturing, installation, and functional defects. It shall be designed, engineered and installed for ease of operation, maintenance, and testing.
2. Provide communications cabling, systems, communications equipment fittings, equipment, conduits, wireways and accessories in accordance with the specifications and drawings. Capacities and ratings of conduit, wireways, cable, locations, other items and arrangements for the specified requirement(s) shall be shown on drawings AND CO-ORDINATED WITH AND LIKE IDENTIFIED IN THE SPECIFICATION CHAPTERS/PARAGRAPHS FOR THE PARTICULAR SYSTEM.

#### 1.6 CODES AND PERMITS (RE PART 1, PARAGRAPHS 1.4.A, D&E. & 1.8.A)

- A. Provide all necessary permits and schedule all inspections as identified in the contract's milestone chart, so that the system is proof of performance tested and ready for operation on a date directed by VA.
- B. The OEM and Contractor are responsible to adhere to all codes, standards and requirements described herein.
- C. The Contractor shall display all applicable national, state and local licenses and permits on the Job Site at the direction of the COR.

#### 1.7 SCHEDULING

- A. After the award of contract, the Contractor shall prepare detailed and proposed Contractor Project Schedule (CPS - aka milestone chart) using "Microsoft Project" software (or COR approved equivalent). The CPS shall:
  1. Indicate detailed activities for the projected life of the project,
  2. Consist of specific activities and their restraining relationships,
  3. Detail manpower usage throughout the project,

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4. Show expected completed portions of the system, in percentage of the total system, which will be available for interim testing / technical investigation at the direction of the COR.
- B. It is the responsibility of the Contractor to coordinate all work with the other trades for scheduling, rough-in, and finishing all work specified. The VA will not be liable for any additional costs due to missed dates or poor coordination of the Contractor or their supplying trades.

**1.8 REVIEW OF CONTRACT DRAWINGS, EQUIPMENT DATA AND SYSTEM OPERATION SUB-MITTALS (AKA TECHNICAL SUBMITTAL[S] - DO NOT DELETE)**

- A. SPECIFICATION ORDER OF PRECEDENCE (Re PART 1, PARAGRAPHS 1.4.A,D,E & 1.6): In the event of a conflict between the text of these documents and the Project's Contract Drawings outlined and / or cited herein; THE TEXT OF DIVISION 27 SECTIONS TAKES PRECEDENCE OVER THE CONTRACT DRAWINGS. HOWEVER, NOTHING HEAREIN WILL SUPERSEDE APPLICABLE EMERGENCY AND SAFETY LAWS AND REGULATIONS, SPECIFICALLY NATIONAL AND / OR LOCAL LIFE AND PUBLIC SAFETY CODES.
  1. The Local Fire Marshall and/or VA Public Safety Officer are the only authorities that may modify this document's EMERGENCY CODE COMPLIANCE REQUIREMENTS, on a case by case basis, in writing, with consensus with CFM's PM, PE and/or COR AND SMCS-0050P2H3a.
  2. CFM's PM, & COR are the only approving authority's for amendments to this document that may be granted, on a case by case basis, in writhing, with technical consensus by SCMS-0050P2H3a and identified Facility Project Personnel.
  3. It is the responsibility of the VA to clarify all issues with this document. When a concern arises - the Contractor shall notify the COR, in writing, on a case by case basis. The COR will render the VA's Official clarification and answer to the Contractor, in writing, covering each submitted question.
  4. The Contractor is again cautioned to obtain in writing, all approvals for system changes relating to the published contract specifications and drawings, from the COR BEFORE proceeding with the change.
  5. Interpret references in these publications to the "AHJ (Re PART 1, PARAGRAPHS D, 1.3.B.1 & 1.4.B.a. (7) (a)," or words of similar value, to mean the CFM: PM, or COR for Project / Contract Guidance; AND VACO SMCS for Technical Concurrence.
- B. SUBMITTALS - in addition with the requirements with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

(Note: The Contractor is encouraged, but not required, to submit separate technical submittal(s) outlining additional or separate technical approach(s) to the system requirements stated here-in as long as each alternate technical document(s) is complete, separate, and submitted in precisely the same manner as outlined herein and meets the System Performance Standards. VA will review and rate each received alternate technical submittal in exactly the same procedure as outlined herein. Partial, add-on, or addenda type alternates will not be accepted or reviewed)

1. VA reserves the right to request the OEM to arrange for a VA Re-presentative (that includes SMCS-0050P2H3a) to see typical active systems in operation, when there has been no prior experience with the OEM or the type of equipment being submitted.
2. VA's approval (that includes SMCS-0050P2H3a certifications) 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.
3. 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.
  - a. Mark the submittals, "SUBMITTED UNDER SECTION \_\_\_\_\_."
  - b. Submittals shall be marked to show specification reference including the section and paragraph numbers ALONG WITH CONTRACT DRAWING REFERENCE.
  - c. Submit each section separately.
4. Each submittal shall include the following: Information that confirms compliance with contract requirements. Include the OEM's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required drawings, and other Contractor data necessary for VA to ascertain the proposed equipment, materials and system design comply with the system's specification requirements.
  - a. OEM Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted THAT INCLUDES ALL NECESSARY CODE COMPLIANCE FOR EACH ITEM OF SUBMITTED EQUIPMENT.
  - b. IF THE SUPPLIED CUTS DO NOT CONTAIN CODE COMPLIANCE (ie FCC, UL, IEEE, etc.), THE CONTRACTOR SHALL PROVIDE THE TESTING LABORATORY COMPLIANCE SHEETS FOR EACH SUBMITTED EQUIPMENT ITEM.
5. Certificates - provide the following certifications:

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- a. Written certification from the OEM indicating the proposed supervisor of the installation and the proposed provider of the contract maintenance are authorized representatives of the OEM. Include the individual's exact name and address and OEM credentials in the certification.
  - b. Written certification from the OEM the installed wiring and connections/diagrams meet National and/or Government Life Safety Guidelines, NFPA, NEC, UL, this specification, and JCAHCO requirements and instructions, recommendations, and guidance set forth by the OEM for the proper performance of the System as described herein. VA will not approve any technical submittal without this certification.
6. Manuals - Submit in addition to the requirements outlined in SECTION 01 00 00, GENERAL REQUIREMENTS, provide:
- a. Maintenance and Operation Manuals - submit as required for systems and equipment specified in the technical sections. Furnish four (4) copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one (1) 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.
  - b. 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.
  - c. 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.
  - d. The manuals shall include:
    - 1) Internal and interconnecting wiring and control diagrams with data to explain detailed system operation and control of the equipment.
    - 2) Description of the function of each principal item of equipment.
    - 3) Installation and maintenance instructions.
    - 4) Safety precautions.
    - 5) Drawings and illustrations.
    - 6) Testing methods.

- 7) Performance data.
  - 8) 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.
  - 9) Appendix - list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.
7. Approvals will be based on complete submission of manuals together with shop drawings.

#### **1.9 PROJECT RECORD DOCUMENTS (AKA AS BUILTS) :**

- A. In addition to the requirements of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES, the following information is made a part of this document's requirements:
- B. Throughout progress of the Work, maintain an accurate record of changes in and on Contract Documents. Upon completion of Work, transfer recorded changes to a set of Project Record Documents.
- C. The floorplans shall be marked in pen to include the minimum following:
  1. Device locations with applied UL labels.
  2. Conduit, Cable, Junction Boxes, Interface Points and specific locations.
  3. TER interface equipment and specific location.
  4. TCO equipment and specific locations.
  5. Inside Vertical and Horizontal conduit locations.
  6. Wiring diagram(s).
  7. Labeling and administration documentation.
  8. Warranty certificate.
  9. System test results.
- D. Fifteen (15) working days prior to the acceptance test, the Contractor shall deliver four (4) complete sets of the Record Wiring Diagrams of the System to the COR. The diagrams shall show all inputs and outputs of electronic and passive equipment correctly identified according to the markers installed on the interconnecting cables, Equipment and room / area locations.
- E. The Record Wiring Diagrams shall be in hard copy and two (2) compact disk (CD) copies properly formatted to match the Facility's current operating version of Computer Aided Drafting (AutoCAD) system. The COR will verify and inform the Contractor of the version of AutoCAD being used by the Facility.

#### **1.10 USE OF THE SITE**

- A. Use of the site shall be at the PC's direction.



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- B. Coordinate with the PC for lay-down areas for product storage and administration areas.
- C. Coordinate work with the PC and their sub-contractors.
- D. Access to buildings wherein the work is performed shall be directed by the PC.

## 1.11 EQUIPMENT

- A. EQUIPMENT REQUIREMENTS: 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. EQUIPMENT PROTECTION - equipment and materials shall be protected during shipment and storage against theft, 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. Painted surfaces shall be protected with factory installed removable heavy craft paper, sheet vinyl or equal.
  - 4. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas is not obvious.
- C. EQUIPMENT INSTALLATION (for additional requirements, see PART 3): Equipment location shall be as close as practical to locations shown on the drawings.
  - 1. Inaccessible Equipment - where the Government determines the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and re-installed as directed by the COR at no additional cost to the Government.
  - 2. "Conveniently accessible" - equipment is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to: motors, pumps, belt guards, transformers, piping, ductwork, hard ceiling, piping, conduit, raceways, etc.

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D. EQUIPMENT IDENTIFICATION - shall be installed with identification sign(s) and nameplate(s) which clearly indicate information required for use and maintenance of equipment; including, but not limited to:

1. Service Panels,
2. Faceplates.
3. Cross-connecting and jacks,
4. TIP cables,
5. Conduits and sleeves,
6. Telecommunication Grounding Bars, Conductors, Connections and System,
7. Firestop certifications,
8. Nameplates shall be laminated black phenolic resin with a white core with engraved lettering, a minimum of 6 mm (1/4 inch) high. Secure nameplates with screws. Nameplates that are furnished by the manufacturer as a standard catalog item, or where other method of identification is herein specified, are exceptions that will be considered by the COR and if approved, the Contractor will be given the COR's decision in writing.

E. DELIVERY, STORAGE, AND HANDLING

1. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft.
2. Store products in original containers.
3. Coordinate with the GC for product storage. There may be little or no storage space available on site. Plan to potentially store materials off site.
4. Do not install damaged products. Remove damaged products from the site and replaced with new product at no cost to the Owner.

1.12 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 communications 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 pathways with other trades to minimize interferences. See the GENERAL CONDITIONS.

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1.13 VA ACCEPTANCE OF SYSTEM MEMORANDUM OF UNDERSTANDING (MOU), CONTRACTORS WARRANTY/  
GUARANTEE

- A. MOU - shall be accomplished with written consensus and signatures of the PC; CFM COR / A/E; Facility's PM, COR & where required, SMCS 0050P2H3a.
1. Clearly states each system / equipment item / condition(s) need-ing attention.
  2. Attach the Punch List:
    - a. Initial Inspection document developed by SMCS 0050P2H3 during system proof of performance testing,
    - b. Contractor's documented compliance - listed item by item recorded and verified by VA's COR and Facility's Manager on the original Punch List.
  3. VA's Condition of Acceptance of the system language to be the last paragraph of the MOU stating (see PART 3, 3.2.E, Acceptance Test Conclusion for VA "Conditions of Acceptance")."
    - a. Without acceptance - until the system fully meets the conditions of the contract; and the system's ownership / use / operation / Warranty / Guarantee to commence at the final acceptance date,
    - b. With conditional acceptance - stating condition(s) that needs addressed by the Contractor / OEM stating the system's owner-ship / use / operation may commence immediately and its Warranty / Guarantee will commence at the final extended acceptance date,
    - c. Full acceptance - with the system's Ownership / Use / Operation / Warranty / Guarantee to commence at the agreed date of final acceptance.
- B. SYSTEM WARRANTY / GURANTY - Telecommunication systems are subject to the terms of "Warranty of Construction", FAR clause 52.246-21.
1. Warranty - The Contractor shall pass through the OEM's equipment warranty for a period of (2) years for Life & Public Safety and Emergency System from the date of acceptance of the system by VA.
  2. Guaranty - the Contractor shall guarantee that system operation, all installed material and equipment will be free from defects, workmanship, and will remain so for a period of (2) years for Life & Public Safety, Critical and Emergency Sys-tem from date of final acceptance of the System by the VA.

## 1.14 SYSTEM PERFORMANCE

- A. GENERAL GUIDELINES: The IWS, herein referred to as the system shall be a DAS. The system shall reliably distribute RF signals and wireless services throughout the specified RF ranges / bands / channels and throughout the specified coverage spaces / areas.

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1. The System shall be implemented based on proven state-of-the-art technology that can seamlessly integrate with the rapid evolution of RF, Wireless Technologies and Business Applications.
  2. The System shall include a head-end subsystem. The head-end shall include a wideband RF transceiver(s) for each required RF for the DAS and be a common interface node. The DAS Head End shall be located as indicated on the drawings .
  3. The IWS shall have all active elements (aka remote units) in secured TRs located in the FMS portion to simplify maintenance and increase system physical security.
    - a. Locating active elements in or above ceilings is not acceptable.
    - b. Locations for active equipment outside the TRs shall be approved by the AHJ and COR.
  4. Radiating or "leaky" coax systems are not acceptable.
  5. Single Mode Fiber Optic cable, protected by conduit and telecommunications listed "partitioned" cable tray is the preferred transmission media for the DAS "trunk lines."
  6. DAS antenna coverage shall be depicted on the Contractor's Required Survey(s) and additionally shown on the contract drawings as described herein.
  7. The Contractor shall provide coverage antennas and/or "nodes" to meet the RF coverage and operational requirements described herein.
  8. The Contractor shall provide a predictive modeling coverage plan(s) showing the design RF coverage (signal strength) for each RF band required for the System.
  9. The Contractor shall provide plans indicating equipment, antenna, and / or component location(s), cable route(s) and other installation information - identify construction elements that would affect the System's performance (ie metallic ceiling materials, air ducts, piping, structural beams, rebar, etc).
  10. The Contractor shall provide detail system one-line and functional block / line diagram(s).
- B. Where possible every building DAS should have two independent connections to the TIP Backbone Raceway.
1. Each DAS connection should enter the building from opposite ends of the building.
  2. Each DAS connection should be brought in through separate TIP paths that provide two distinct DAS connections to the TIP backbone raceway giving each building a redundant connectivity in the case of a cable plant damage.

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3. Due to the number of critical, emergency and safety systems that are now run on the VA Low Voltage TIP it is imperative that we provide redundancy into the TIP. Services such as DAS, fire alarm signaling, Security swipe card door locks, Emergency Phones, Emergency 911, Code Blue, Duress Alarm, Patient / Staff Location, etc. require a highly available, high quality TIP.

**PART 2 - PRODUCTS****2.1 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS:**

- A. Furnish and install a complete and fully functional DAS Equipment and cable distribution system for each: Interface Location, TER, and TCO(s) WHOSE COMMUNICAITONS EQUIPMENT ROOM FITTINGS, INSIDE (BACKBONE INCLUDING VERTICAL AND HORIZONTAL) CONDUIT DISTRIBUTION SYSTEMS WERE PROVIDED AS A PART OF SECTION 27 11 00. ADDITIONAL TIP CABLE INSTALLATIONS AND MOUNTING METHOD(S) ARE NOT ALLOWED UNLESS PREVIOUSLY APPROVED BY THE COR AND SMCS 0050P2H3 IN WRITING.
- B. The specific locations for each as are shown on the drawings
- B. TCO(s): Deliver at all TCOs fully functional DAS communications cables in the specific locations shown on the drawings (Note - the inside vertical (Backbone) functional communications cables are in addition to those provided by SECTION 27 10 00 - STRUCTURED (BACKBONE) COMMUNICATIONS CABLING EQUIPMENT AND SYSTEMS.
1. Provide activated special communications DAS functional jacks and corresponding plant, as dictated by the approved system design, in the unused jack space in each of the aforementioned TCOs.
- C. The System shall include, but not be limited to: Directional (a.k.a. Hy-Gain), interior Omi-Directional and directional donor outdoor antenna(s); coaxial (a.k.a. spiral line)cable and connectors; antenna masts; antenna multi-couplers; lightning protection system; HE and interface cabinets; RF terminals and amplifiers; UPS; electronic supervision functions and control with Fire Alarm interface; conduit, cable duct and/or partitioned cable tray; and, necessary passive devices such as fiberoptic and TWP (shielded or unshielded) cable with connectors; attenuators, combiners, traps, filters and splitters:.
1. The System shall provide DAS two way radio communications from a minimum of the following services:

REQUIREMENTS	FUNCTIONS
a. Three (3) each	Emergency two-way emergency radio responder sub-systems (ie local fire department, police and EMS) to be operated by a separate RF connection to a common antenna coupling network, RF transmission line, and single outside antenna and provide appropriate interconnecting cabling to the system's control units.

b. Plus,	The three (3) emergency responder radio subsystems shall function from the same outside antenna. <u>The system shall allow the installation of an additional antenna coupler at the present or future time when system expansion is require above the numbers identified herein.</u>
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D. Please see PART 2, PARAGRAPH 2.1, SECTION 27 05 00 for additional requirements.

## 2.2 SYSTEM DESCRIPTION

A. The System shall meet the requirements of the AHJ for PSRAS functions and operation.

1. The DAS shall have active signal handling by using active element(s) that filter and amplify signals on RF specific band/channel basis to consistently deliver In House RF Services at the appropriate power levels in the locations described herein, depicted on the Contractor's Surveys and on as shown the contract drawings. When any of these mandatory requirements are found missing, contact the COR who will contact SMCS 0050P2H3 for directions.
2. Frequency Range: The system shall support all RFs in the between 700 and 800 mHz bands.
3. The system shall distribute RF coverage at levels described herein in the following minimum areas of the building(s) and as listed herein:

REQUIREMENT	FUNCTION
a. General Building Areas	Provide coverage at 90 percent of the floor areas for floors Pipe Basement up to and including the 3 <sup>rd</sup> floor.
b. Critical Areas	Provide coverage to 99 percent in areas considered critical including; exit stairs, exit passageways, elevators and elevator lobbies, standpipe and sprinkler equipment spaces, Police dispatch, Emergency Services, Areas of Rescue Assistance, Main electrical/Mechanical/Telephone rooms.
c. Excluded Areas	NO AREAS ARE EXCLUDED

4. The system shall be able to simultaneously support the following VA APPROVED minimum RF, wireless services, applications and / or technologies. The System shall:
  - b. Support VA's FMS and other RF systems (RFs for the following radio systems shall be supported, at a minimum. The DAS Contractor shall confirm the

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RFs required at the time technical submittal submission and again at Facility opening):

REQUIREMENT	FUNCTION
1) PSRAS Responder(s)	
a) The system shall distribute <b>Public Safety Channels</b>	with a signal strength that exceeds the minimum requirements specified herein and by the AHJ
b) 99 - 100% in house coverage	is expected in all Critical areas of the building from floor Pipe Basement to 3 <sup>rd</sup> floor.
c) Public Safety includes	VA, Local, City and State Police, County Sheriff, Emergency Medical Services (EMS), and Fire Departments
<u>1.</u> VA Police 800 MHz	no FCC restriction(s)
<u>2.</u> VA Emergency 800 MHz	no FCC restriction(s)
<u>3.</u> Local PD 800MHz	no FCC restriction(s), FCC Part 25 listed requires MOU & CUP
<u>4.</u> City PD 800MHz	FCC restriction(s), FCC Part 25 listed requires MOU & CUP
<u>5.</u> State PD 800MHz	no FCC restriction(s), FCC Part 25 listed requires MOU & CUP
<u>6.</u> County Sheriff 800MHz	no FCC restriction(s), FCC Part 25 listed requires MOU & CUP
<u>7.</u> Fire Department(s) 800MHz	no FCC restriction(s), FCC Part 25 listed requires MOU & CUP
<u>8.</u> Local EMS(s) 800MHz	no FCC restriction(s), FCC Part 25 listed requires MOU & CUP

B. Specific Subsystems' Requirements: The system shall have the capability for separate control over each service (and wireless operator) to all the ability to adjust and control power levels without disturbing other services / operators.

The System shall:

1. Support multiple services in modular architecture so services can be added or removed without:
  - a. Requiring new infrastructure,
  - b. Readjustment of signal power levels,
  - c. Disturbing existing services.
2. Enable services to be added without requiring additional cabling or antennas.
3. Not impede any management feature(s) or functionality or any attached network and / or device management system.

4. Allow for proactive management and end-to-end alarming of active equipment components, resulting in rapid problem identification and resolution.
5. The System shall support:
  - b. Associated wireless devices that comply with FCC's and Regional regulatory authorities' emission rules for wireless devices.  
(Note - refer to: FCC Advisory #A, Local Government Official's Guide to Transmitting Antenna RF Emission Safety Rules, Procedures and Practical Guidance, FCC's OET Bulletin 65, FCC Rule 47, Part 15 "Safety of Life prohibitions" and ANSI/IEEE C95.1-1992, Hazardous Emission document)
6. The System's input AC power shall be provided with and connected to both a normal dedicated circuit and an emergency, generator supplied circuit in addition to a local UPS. The UPS shall support the System operation (under a full load) for a minimum of 10 minutes. The UPS shall be connected to the Facility's Essential Generator Backed-up Electrical System (Note: depending on System design - there may be necessary to provide multiple UPS for the System).
7. The System shall be provided with an Electrical Supervision that shall monitor all operating states of the System and each UPS. The supervision shall be through the fire alarm system and shall notify maintenance personnel of System Failure(s) and types.
  - a. The Supervision Alarm(s) shall not be cancelled until the trouble / fault has been corrected and the System has been restored to normal operation.
  - b. The following system trouble/fault conditions shall be annunciated at a minimum:
    - 1) Antenna Malfunction
    - 2) Signal Booster malfunction
    - 3) Low battery capacity of UPS
    - 4) Loss of normal AC power
    - 5) Loss of emergency AC power (UPS activated)
    - 6) AC power supply failure within signal booster assembly.
8. The System shall be designed to minimize cross talk, background processor noise, inter-modulation and other signal interference. The HE equipment shall be installed and interfaced according to the OEM HE schematic diagram for adjacent audio, video, data and RF channel operation.
9. The contractor shall provide one (1) spare outside antenna with 100' of RF coaxial cable with connectors installed to be coiled, located and secured in the HE Room and be labeled "DAS EMERGENCY RESPONDER SPARE ANTENA."



## C. Cabling

1. Fiber Optic cabling is specified herein and shall be provided on Special System Fiber Optic DAS / TIP Backbone diagrams. The Contractor shall identify in shop drawing submittal one-line riser diagram(s) indicating the mode and number of strands required.
2. 50 Ohm coaxial cable and terminations as specified herein.
3. A system distribution design that promotes "looping" the fiber optic and coaxial cables from location to location shall not be permitted. Each location and/or floor fiber optic and coaxial cable transmission line system shall be a "tap" design where each cable is fed from a device provided from a centrally corridor located lateral DAS trunk-line cable(s). Each location or floor lateral DAS trunk-line cable shall be connected to a vertical DAS trunk-line riser cable in the associated TR. Each vertical riser DAS trunk-line cable shall be connected to the HE input and/or output, depending on system design. Distribution (floor or riser) DAS amplifiers may be needed to satisfy the System's DAS received and/or transmit signal level requirements at each location. The provided DAS trunk line that routes throughout the interior of the Facility shall be separated from other systems and protected from damage by conduit and partitioned cable tray.
4. Each floor and/or office control and interface system shall be protected using conduit and partitioned cable tray. The use of open ladders, "J" hook, "O" rings, "U" clamps, etc is not allowed for installation of Emergency, and/or Support system cables.
5. Each floor and/or office control and interface system shall be provided in a "buss" design where each location's and/or floor's radio control console and/or control equipment is fed from centrally located (usually in the corridor) lateral trunk-line cables. Each signal closet shall contain a MIN of one terminal cabinet capable of connection to vertical trunk-line riser cables to lateral trunk-line cables in the associated signal closet and as shown on the drawings or recommended by the OEM.
6. Interface Cabinet Location (Consult Design Guide PG-18-10, Chapters 7 & 8 for specific instructions): Each cabinet shall be provided, protected, and located at the most central distribution system signal closet location to insure optimum origination, reception and control of all system signals. Each cabinet shall be provided with an internal active 120 VAC quad receptacle. Each cabinet shall be provided with a MIN of 610 mm (two feet) clearance from all obstructions in the signal closet where located. Each cabinet shall be

provided as required to meet the multiple audio channel and RF requirements and system performance standards.

- D. **Interference**: There shall be no interference between the applications and wireless operators specified herein and with the Facility's equipment.
- E. Telecommunication Rooms (TR): refer to CFM's EDM and OI&T Design Guide for this requirement if not specifically identified in the projects' construction documents.

### 2.3 MANUFACTURERS

- A. The products specified shall be new; FCC AND NRTL (aka UL) listed, labeled and produced by OEM of record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:
1. Maintains a manufacturer and bench stock of replacement parts for the item(s) submitted,
  2. Maintains technical drawings and specifications; architectural, engineering, depot level repair and operating manuals for the items submitted,
  3. Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid (IFB),
  4. Shall have equipment items that have been in satisfactory operation, on a minimum of three (3) installations of similar size, complexity and type as this project.
    - a. Materials and equipment furnished shall be of current production by OEM(s) regularly engaged in the manufacture of such items, for which replacement parts shall be available for at least five (5) years from the date of acceptance by VA.
    - b. When more than one unit of the same class of equipment is required, the: equipment, cabling, terminating hardware, TCOs, and patch cords shall be sourced from the certifying OEM; OR at the OEM's direction, and support the System design, the OEM's quality control and validity of the OEM's warranty.
  5. VA reserves the right to require the Contractor to submit a list of installations and contact information where the products have been in operation before approval as described in Paragraph 1.8 - "Technical Submittal" portion of this document.
    - a. Equipment Assemblies and Components
      - 1) Components of assembled units need not be products of the same OEM.

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- 2) OEMs of equipment assemblies, which include components made by others, shall assume complete responsibility, warranty and guarantee for the final assembled unit as described herein.
  - 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 OEM.
- b. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.
- B. Specifications contained herein detail the SALIENT operating and performance characteristics of equipment in order for VA to distinguish acceptable items from unacceptable items of equipment. When an item of equipment is offered or furnished for which there is a specification contained herein, that item of equipment offered or furnished shall meet or exceed the specification.
- C. Equipment Standards and Testing
1. The System has been defined herein as connected to systems identified and listed as Emergency Care performing Life Support, Emergency and Safety Functions. Therefore, at a minimum, the system shall conform to all aforementioned National and/or Local Life Safety Codes (which ever are the more stringent), NFPA, NEC, this specification, JCAHCO Life Safety Accreditation requirements, and the OEM recommendations, instructions, and guidelines.
  2. The provided equipment required by the System design and approved technical submittal must conform with each NRTL (aka UL) standard in effect for the equipment, as of the date of acceptance of the technical submittal (OR the date when the COR approved system equipment necessary to be replaced) and was technically reviewed and approved by SMCS.
    - a. Where a NRTL (aka UL) standard is in existence for equipment to be used in completion of this contract, the equipment must bear the approved UL Seal or Mark; OR the Seal or Mark of the NRTL Testing Laboratory that warrants the equipment has been tested in accordance with, and conforms to the UL standard(s).

Contact DoL (OSHA) for an up to date list of NRTLs at:  
[http://www.osha.gov/dts/otpcanrtl/faq\\_nrtl.html](http://www.osha.gov/dts/otpcanrtl/faq_nrtl.html)
    - b. The placement of the NRTL (aka UL) Seal or Mark shall be on a permanent part of the equipment that is not capable of being transported from one equipment item to another.

## D. When Factory Testing is Determined Necessary:

1. VA shall have the option of witnessing factory tests. The Contractor shall notify the VA through the COR a minimum of 21 days (aka three [3] weeks) prior to the OEMs making the factory tests.
2. The OEM shall furnish four (4) copies of certified test reports containing all test data to the COR prior to final inspection and not more than 30 days after completion of the tests.
3. When equipment fails to meet factory test and reinspection is required, the OEM shall be liable for all additional expenses, including expenses of the Government.

**2.4 EQUIPMENT ITEMS**

A. GENERAL REQUIREMENTS (see PART 2, PARAGRAPH 2.4, SECTION 27 05 11 for additional requirements): The equipment identified in this SECTION shall be the standard product(s) of an OEM regularly engaged in the manufacture of DAS and related products. All components used in the System shall be commercial quality products that comply with this document. Each component of equipment shall identify the OEM's name, model, serial number, FCC Listing and NRTL (aka UL) label or equal. The COR retains the right to reject products which reflect, in the COR's opinion, sub-standard design practices, manufacturing procedures, support services, or warranty/guarantee policies. Refer to contract drawing(s) note(s) for additional OEM information.

1. All copper cables are not required to be plenum rated if run in protective conduit and not installed "Air Plenum Areas" designated by the COR. If run outside of conduit, each fiber optic cable shall contain an inner wrap of Kynar or Teflon (or equal) plus a metal protective wrap (sometimes called 'armor') just inside the outside protective jacket.
2. Fiber Optic Transport: are not required to be plenum rated if run in protective conduit and not installed "Air Plenum Areas" designated by the COR. When Fiber Optic Transport media is utilized; the IWS shall utilize single-mode with angle polished connectors (APC) to distribute DAS signals.
3. Broadband (Coaxial) Distribution: When Broadband Distribution is utilized; the IWS shall use coaxial cable in the horizontal runs and passive (ie non-powered) broadband antenna(s) in the respective area(s). The coaxial cables are not required are not required to be plenum rated unless installed in designated "Air Plenum Locations."
4. Baseband (Video and Audio) Distribution: When Baseband Distribution is utilized; the IWS shall use TWP or STP cable in the horizontal runs and

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passive (ie non-powered) baseband equipment to compliment the DAS in respective area(s). The baseband cables are not required are not required to be plenum rated unless installed in designated "Air Plenum Locations."

5. The Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating DAS system (and sub - systems) with 40% growth / expansion THAT IS BASED ON THE TOTAL NUMBER OF WIRED HORIZONTAL ANTENNA POINTS PLUS THE CAPABILITY OF ADDING AN ADDITIONAL 40% OF ANTENNA POINTS AND SUPPORT EQUIPMENT WITHOUT DISTURBING THE SYSTEM'S INFRASTRUCTURE DESCRIBED HEREIN.

- a. The equipment quantities provided herein shall be as indicated on the drawings with the exception of the indicated spare equipment where all shall be listed on the BOM.
- b. Each system interface point shall be provided with internal and external items to maintain a neat and orderly system of equipment and conduit connections and routing (Refer to CFM's PG-18-10 Electrical Design Manual for VA Facilities, Table 7-1 and Appendix B, Suggested Telecommunications Online Topology; AND OI&T Design Guide for technical assistance in identifying required Interface Point(s) and interconnecting DAS internal plant conduit requirements.
- c. Conduit, 1.0" minimum (¾" may be allowed on a case by case basis by the COR in writing) is required for all Life, Patient, Staff and Public Safety, Critical Service and Emergency Systems.
- d. Equipment Functional Characteristics

FUNCTIONS	CHARACTERISTICS
Input Voltage	105 to 130 VAC
POWER LINE FREQUENCY	60 HZ ±2.0 HZ
Operating Temperature	0 to 50 degrees (*) Centigrade (C)
Humidity	80 percent (%) minimum rating

6. SPECIFIC EQUIPMENT DESIGNATED BY THE DAS SYSTEM DESIGN

a. Antenna Equipment and Materials

- 1) Antenna Site(s) & Installation: It is the responsibility of the Contractor to re-verify and certify each external and internal antenna installation required by the system, in writing (four (4) copies MIN), to the COR 30 days prior to construction. The Contractor is required to provide all FAA, FCC and local licenses and permits for each radio antenna item(s) requiring such licenses and permits. Additionally, at a MIN, for each external antenna site that is 75' above average ground

level (AGL) or taller than appurtenances and closer buildings or objects, the Contractor shall accomplish FCC Form 854, Application for Antenna Structure Registration, FAA Advisory Circular AC 70/7460-1, Obstruction Marking and Lighting and FAA Form 7460-1, Notice of Proposed Construction and Alteration for each item requiring this registration. It is the Contractor's responsibility to contact the local licensing authority(s) to determine if the antenna installation requires additional hazard registration and accomplish all necessary documents.

- 2) THE SYSTEM PROOF OF PERFORMANCE AND VA CERTIFICATION TESTS WILL NOT BE CONDUCTED UNTIL THESE FORMS ARE ACCOMPLISHED AND SUBMITTED TO THE APPROPRIATE FEDERAL AUTHORITIES WITH COPIES PROVIDED TO THE COR, OR VAMC CO AND VACO SMCS (0050P2H3). The Contractor shall obtain onsite technical assistance from the OEM for installation of the external antenna(s) selected during the Field Site Visit. The Contractor shall provide the COR a detailed written report of the findings of this visit for approval. The site visit and report shall be completed during the 30 days after issuance of the notice to proceed.
- 3) Wherever possible, external antenna equipment shall be mounted so that maintenance can be accomplished without the need to climb towers, ladders, cherry pickers, etc.
- 4) External Antenna Masts: Wall mounted DAS antenna mast(s) shall be rigid thick wall and have a minimum 3.0 inch (75mm) outside diameter (OD), of hot dip galvanized steel and capable of surviving MIN wind loads of 100 miles per hour (160 kilometers per hour) sustained winds with all DAS antenna equipment and mounting hardware installed, with up to 1/2 inch (12.7 mm) radial ice at the height required to provide the System performance, as described herein.
  - a) Wall mounted external masts shall be attached to building walls, penthouse walls or other solid parts of the building exterior free of all obstructions.
  - b) For building and penthouse walls, attach masts with not less than three (3) rust proofed brackets three (3) inches (76.2 mm) wide, 5/16 inch (7.79375 mm) thick, eight (8) inches (177.8254 mm) wide and spaced not less than 20 inches (508.0 mm) apart. Do not attach masts to catwalks or metal structures unless specifically approved. If allowed, masts shall be welded or bolted to the structure using

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an approved method of attachment. All connections shall be rustproof and painted to match the existing structure(s).

- c) Fasten the mounting brackets with rust proofed through bolts of a minimum 7/16 inch (11.1125 mm) diameter, each anchored with two (2 - one on the inside and one on the outside of the wall), (8 inch (203.2 mm) square, 5/16 inch (7.9375 mm) thick rust proofed steel back plates. Attachments to mortar or grout joints with lag bolts are not permitted. Securely tighten all mounting hardware, antenna hardware and terminals.
  - d) Do not mount the mast(s) directly on the roofs of the building or penthouse unless specifically approved in writing by the COR prior to installation. Any approved roof attachment or penetration shall be resealed to prevent water leakage; using pitch pocket or other method approved by the roof OEM and Roofing Contractor.
  - e) Do not install more than two (2) antennas on a single mast. Install separate masts, as required, with proper physical and frequency spacing between them and the antenna(s) installed. A MIN spacing shall be 1/2 wavelength ( $\lambda$ ) vertically and 5/8  $\lambda$  horizontally (element tip to element tip) for the lowest operating frequency.
  - f) Orient the antenna(s) to insure optimum signal receive level and S/N ratio.
  - g) Weatherproof all connections with approved sealing compound. Electrical cloth or plastic tape are not acceptable and will not be approved.
- 5) Antenna Site Physical Protection
- a) External
    - (1) Roof and/or Wall Type: When an antenna is installed on a building roof or wall that is accessible from the roof, signs shall be placed on all roof access points that say "Warning, Radio Antenna Radiation Hazard." The signs shall be professionally prepared, neat and permanent. The roof area where the antenna is installed shall be painted yellow or roped off with a yellow marker tape that indicates the approximate area of RF radiation.
    - (2) Each roof or attic access for the each antenna shall be controlled by the VA Police SMS Access Control System. The Police Chief will determine the appropriate number and individual(s) that are to be granted access in these areas.

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- b) Internal DAS: The antenna shall be placed inside a protective enclosure designed specifically for the product. The antenna shall not be visible when installed in the enclosure in the area located. DAS cables to each antenna shall be installed in protective conduit (EMT or Flex) from each Antenna Enclosure to the associated "J" Box. Each DAS Antenna Enclosure shall be provided with two (2) safety wires connected between each enclosure to solid building supports.
- 6) Antenna Site Lightning Protection System: Each protection system shall be provided in its entirety totally and externally to the building. The use of internal electrical or communications grounding systems is not acceptable, will not be approved; and if found during the system's proof-of-performance tests, it will be removed and the test may be terminated and rescheduled at the contractor's expense.
- a) Antenna, Mount & Mast: The antenna, antenna mount or mast and transmission line shall be grounded with cooper wire run external to the building and connected to the earth ground. If the antenna is to be installed in an area not protected by lightning rods or if the antenna is to be elevated above existing building's lighting rod protection, the Contractor shall immediately notify the COR in writing regarding the lightning strike hazard.
- b) RF Transmission Line and/or Coaxial Cable Lightning Protector: The protector shall be an in-line device equipped with screw type connectors to match the coaxial cable and dimensions specified. It shall be able to shunt high current surges to the earth ground protecting the system signal RF equipment. The protector shall have a minimal effect on the quality of the signal being received or transmitted. It shall be made of non-corrosive metal and be waterproof.

## (1) Technical Characteristics

<b>FUNCTIONS</b>	<b>CHARACTERISTICS</b>
<u>a</u> . Peak Pulse Power	1,500 W @ 77° F
<u>b</u> . Protection Device	Gas Tube or as required by OEM
<u>c</u> . Dissipation	1.0 Milliseconds (mS)
<u>d</u> . Response Time	5.0 nano-Seconds (nS)
<u>e</u> . Connectors	As Specified



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<u>f.</u> Ground Connection(s)	The protector shall be directly mounted, by a #4 ga. MIN self taping sheet metal screw, on a MIN 5/16" (7.9375 mm) thick, 4.0" (101.6 mm) high X 22.0" (609.6 mm) Long solid copper buss grounding plate mounted directly inside and anchored to the wall at the exact coaxial cable entrance. The grounding plate shall be connected by a #0 AWG Stranded Copper Wire, MIN, or as required by the OEM, and/or the COR connected to the FACILITY'S OUTSIDE LIGHTNING PROTECTION SYSTEM.
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(2) Each lightning major ground point shall be connected with MIN #0 AWG stranded copper wire run external to the building and connected to the antenna site lightning ground described herein.

7) Antennas

a) External: The external antenna shall be specified by the OEM for the specific system function and physical location. Acceptable designs are: ground plane fed with continuous polarization adjustment and or spread spectrum type. The antenna size, gain and beam width shall be chosen for optimum performance to meet the specified path and System reliability parameters.

(1) Each antenna shall be installed to meet the wind load specifications and environmental conditions.

(2) Technical Characteristics

FUNCTIONS	CHARACTERISTICS
<u>a.</u> Operating Standards	As herein outlined and specified
<u>b.</u> Size	As required to fully satisfy system design
<u>c.</u> Gain	25 dB
<u>e.</u> Half Power Beam Width	As specified by the OEM
<u>f.</u> Front-to-Back Ratio (FBR)	40 dB
<u>g.</u> VSWR	1.15 or Less
<u>h.</u> RFI	None measurable
<u>i.</u> Wind Load Rating	40 LBS Per Square Foot (PSF) or 100 (160 kilometers) per hour

(3) RF Transmission Line (External) - Coaxial: The provided transmission line shall be coaxial, jacketed with fire resistant material when run outside of conduit and/or cable tray, or as required by system design and described by the OEM; and, if required, pressurized to the OEM's specifications.

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- (i) The cable shall be as specified by the OEM. If not specified by the OEM, it shall be provided with the proper impedance, be double shielded, and contain other characteristics to satisfy all equipment and system requirements.

(ii) Technical Characteristics

(1 Outside Diameter	As specified by the OEM
(2 Center Conductor	Solid (Stranded when OEM specified) Copper, Silver Coated
(3 Outer Conductor (or Braid)	Braided Copper (solid when OEM specified) providing 100% coverage and EMI shielding
(4 Insulation	Cellular Polyethylene with air passages
(5 Jacket	Polyethylene; Teflon or Kynar (when required)

(iii) Attenuation:

Frequency (mHz)	Attn/dB per 100 ft (MAX)
100	2.5
200	3.5
400	5.0
890	8.0

- (iv) External Antenna Feed Through: A feed through shall be provided for all Coaxial, Spiral line and/or other System wire/cable penetrations of exterior building walls or roofs. The feed through(s) shall be waterproof, sleeved, OEM recommended and COR approved.

- b) Internal: Each DAS antenna shall be specified by the OEM for the specific system function and physical location. Acceptable designs are: ground plane fed with continuous polarization adjustment and or spread spectrum type. The antenna size, gain and beam width shall be chosen for optimum performance to meet the specified path and System reliability parameters. Each antenna shall be installed to meet the local environmental (outside and inside) conditions.

(1) Environmental

FUNCTIONS	CHARACTERISTICS
(a Application	Indoor
(b Operating Temperature	40°C to +60°C (40°F to +140°F)
(c Relative Humidity	Up to 100%

(2) Mechanical

FUNCTIONS	CHARACTERISTICS
(a Application	50 Ohm "N" type
(b Mounting	Thru-hole ceiling (typical)
(c Relative Humidity	Up to 100%
(d Radome	Required, ABS, UV resistant
(e Pigtail Cable	Required, plenum (if not protected) flexible with connectors installed

## (3) Regulatory Compliance

FUNCTIONS	CHARACTERISTICS
(a RoHS	2002/95/EC (minimum)

(4) Omni-Directional Antenna: Omni-Directional Coverage Antenna(s) shall feature a multi-band design that accommodates multiple RF band and channels in a single unit.

## (i) RF Band One (1)

FUNCTIONS	CHARACTERISTICS
(1 RF Range	690 - 800 mHz
(2 VSWR	$\leq 1.8:1$
(3 Gain	$\geq 1.5$ dBi
(4 Max input power	OEM Specified
(5 Impedance	50 Ohms
(6 Beamwidth:	
(a Vertical	80° nominal
(b Horizontal	360° Omni-directional
(7 Return Loss	$\leq 11$ dB, maximum,
(8 RFI	None measurable
(9 Wind Load Rating:	
(a External	40 LBS Per Square Foot (PSF) or 100 MPH
(b Internal	Not Applicable

## (ii) RF Band Two (2)

(5) Directional Coverage Antenna(s): shall feature a multi-band design that accommodates multiple RF band and channels in a single unit.

## (i) RF Band One (1):

FUNCTIONS	CHARACTERISTICS
(1 RF Range	690 - 800 mHz

(2 VSWR	$\leq 1.8:1$
(3 Gain	$\geq 5.0$ dBi
(4 Max input power	50W MAX
(5 Impedance	50 Ohms
(6 Beamwidth:	
(a Vertical	Polarization
(b Horizontal	110° nominal
(7 Return Loss	$\leq 11$ dB, maximum,
(8 RFI	None measurable
(9 Wind Load Rating:	
(a External	40 LBS Per Square Foot (PSF) or 100 MPH
(c Internal	Not Applicable

b. Head End (HE) Equipment

1) DAS Equipment Room/Location

- a) The Contractor shall confirm each HE room/location depicted on the contract drawings conforms to the MIN requirements outlined in CFM's Design Manual PG-18-10 - Chapter 7 and OI&T Design (a copy can be obtained from the COR or SMCS 0050P2H3).
- b) Any noted deviation(s) shall be provided to the COR in writing for an official determination concerning each noted item and how it/they will affect the system.
- c) The COR shall contact SMCS (0050P2H3) for technical assistance and the A/E for structural assistance.

B. CABINET WITH INTERNAL EQUIPMENT MOUNTING RAIL(S) (DO NOT DELETE): shall be lockable, fabricated of heavy 16 gauge (ga) steel, and have fully adjustable internal equipment mounting racks and/or rails that allows front panel equipment mounting and access.

1. Each equipment mounting rail shall be able to provide an internal cabinet ground for each installed equipment when the equipment is properly bolted to the rail.
2. Additionally, connect each equipment grounding terminal to a separate mounting hole on the equipment mounting rail to the right as one looks at it from the rear with a minim #12 AWG stranded copper wire with protective jacket.

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3. It shall have baked-on iron phosphate primer and baked enamel paint finish in a color to be selected by the COR or FMS Service Chief.
4. It shall be floor or wall mounted with knock-out holes for cable entrance(s) and conduit connections, contain ventilation ports and a quiet fan with non disposable air filter for equipment cooling.
5. Each cabinet shall be keyed alike and four (4) keys shall be provided to the COR for each 10 cabinets used when the VA accepts the System.
6. A minimum of one (1) cabinet shall be provided with blank rack space, for additional expansion equipment. Blank panels shall be installed to cover any open or unused rack space. In addition, provide two (2) 120 VAC power strips connected to surge protector(s), a ventilation fan with non-disposable air filter, and a conduit or cable duct interfaced to adjacent cabinet(s) and local room wire management system, as part of this cabinet.
  - a. Blank panels shall be color matched to the cabinet, 1/8in. (3.175 mm) thick aluminum with vertical dimensions in increments of one rack unit (RU) or 1.75in. (44.8469 mm) with mounting holes spaced to correspond to EIA 19in. (482.6 mm) rack dimensions.
  - b. Single standard larger size blank panels shall be used to fill unused panel or rack spaces in lieu of numerous types. One blank 1.75in. (44.8469 mm) high blank panel shall be installed between each item of equipment.
7. Provide internal cabinet communications grounding system and connect to communications ground buss bar with a minimum #6 AWG stranded copper wire with protective covering(see PART 2, PARAGRAPH 2.4.B).
  - a. Each cabinet shall be grounded to the communications grounding system.
  - b. Connect the communications system grounding wire to a cabinet provided ground terminal or with a bolt(s) screwed into one mounting hole of each equipment mounting rail (refer to PARAGRAPH 2.9 HEREIN).

## 8. Technical Characteristics

Overall Height	2,180 mm (85 7/8in.), maximum
Overall Depth	650 mm (25 1/2in.), maximum
Overall Width	535 mm (21 1/16in.), maximum
Front Panel Opening Width	480 mm (19in.), EIA horizontal
Hole Spacing	per EIA and Industry Standards

## 9. Internal Cabinet Components (MINIMUM REQUIRED)

- a. AC power outlet strip(s - DO NOT DELETE):
  - 1) Two (2) Power outlet strips shall be provided as directed by the OEM.

The additional spare equipment cabinet with no installed items in the

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cabinet shall contain two (2) AC strips with a minimum of 10 ea. AC power outlets. Each strip shall be mounted inside and at the rear of the cabinet. It shall contain "U" grounded AC outlets for distributing AC power to the installed electronic equipment. The strip shall be self-contained in a metal enclosure and may be provided with a 2 M (6 ft.) long (maximum) connecting cord with three prong plug.

2) Technical Characteristics:

- a) Power capacity 20 Ampere (AMP), 120 VAC continuous duty.
- b) Wire gauge: Three conductor, #12 AWG copper.

b. Cabinet AC Power Line Surge Protector and Filter:

- 1) Each cabinet shall be equipped with a AC Surge Protector and Line Filter. The Protector and Filter shall be housed in one single enclosure. The Protector and Filter shall perform instantaneous regulation of the AC input voltage and isolate and filter any noise present on the AC input line. The unit shall be equipped with AC voltage and current surge protectors to prevent damage to the electronic equipment from power line induced voltage spikes, surges, lightning, etc. It shall be cabinet mounted and the cabinet AC power strip (maximum of two [2] strips) may be connected to it as long as the system design is met.

2) Technical Characteristics

Input Voltage range	120 VAC $\pm$ 15%
Power capacity	20 AMP, 120 VAC
Voltage output regulation	$\pm$ 3.0%
Circuit breaker	15 AMP, may be self contain
Noise filtering	Greater than -45 dB
AC outlets	Four (4) duplex grounded types, minimum
Response time	5.0 ns
Suppression	
Surge	10,000 A
Noise	
Common	-40 dB
Differential	-45 dB

3) Specific requirements for current and surge protection shall include:

- a) Voltage protection threshold, line to neutral, starts at no more than 220 Volts peak. The transient voltage shall not exceed 300

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volts peak. The Contractor shall furnish documentation on peak clamping voltage as a function of transient AMP.

- b) Peak power dissipation minimum 35 Joules per phase, as measured for 1.0 mS at sub branch panels, 100 Joules per phase at branch panels and 300 Joules per phase at service entrance panels. The Contractor shall furnish an explanation of how the ratings were measured or empirically derived.
- c) Surge protector must not short circuit the AC power line at any time.
  - (1) The primary surge protection components must be silicon semiconductors. Secondary stages, if used, may include other types of devices.
  - (2) Surge protectors shall incorporate a visual device which indicates whether the surge suppression component(s) is (are) functioning.
  - (3) Surge protection devices shall be UL listed.
  - (4) Voltage and current surge protectors shall be provided on all ancillary equipment provided by the Contractor.
- d) Power dissipation 12,000 Watts (W) for 1.0 mS (or 12 Joules).
- e) Voltage protection threshold starts at not more than 100 VAC.
- c. Uninterruptible Power Supply (UPS): Each cabinet shall be provided with an internal UPS. This item may be combined with the Surge Protector & Filter in PART 2, PARAGRAPH 2.4.I.8.b as long as the 50% expansion is met. The UPS shall provide at least one (1) hours continuous full load //two hours if working with an emergency / safety system// uninterruptible system primary AC Power, with a 25% (at least ten minutes) reserve capacity, in the event of Facility Primary or Emergency AC Power failure.
  - 1) The UPS shall include, but not be limited to:

a) Protection switch	Required to automatically protect the UPS unit and associated equipment connected to it. <b>This function is required to be a part of the System's electronic supervision requirements.</b>
b) First/fast charge unit	Must provide clean predicable charge voltage / current when needed. This function is required to be a part of the System's electronic supervision requirements.
c) Over Voltage/Current protect	Must not short circuit the AC power line at any time. This function is required to be a part of the System's electronic supervision requirements.

d) Trickle charge unit	Must be cable of maintaining a suitable internal battery charge without damaging the batteries.
e) Internally mounted	Per OEM's direction.
f) Proper ventilation	Not override the cabinets' ventilation system.
g) Power change from AC input	Shall be accomplished without interruption to the communications link or subsystem being protected. <b>This change of state shall generate visual and aural alarms in its Electrical Supervision System.</b>
h) Electrical supervision	Required - must be audible and visual locally and remotely to annunciating panel(s) via direct connection for trouble indication

C. ENVIRONMENTAL CABINET (if selected): The Contractor shall provide this enclosure in lieu of a standard equipment cabinet identified in Paragraph 2.4.B to meet system design in hostile TR locations as identified in CFM's OI&T Design Guide and locations as shown on the drawings.

1. The enclosure shall fully sustain the installed, including electronic, equipment in the same manner as the standard cabinet identified in Paragraph 2.4.B. Additionally, the enclosure shall fully support all installed equipment as if they were in a standalone air handling area regardless of the local area's air handling capabilities.
2. The enclosure shall be an OEM's fully assembled unit.
3. If more than two enclosures are required in any system location, those enclosures shall be OEM assembled for consolidating or combining two or more enclosures in a single unit to meet system space and equipment handling designs plus maintain OSHA spacing requirements.
4. Technical Characteristics

a. Environmental control	Automatic, heating and/or cooling, as required
b. Temperature conditions (rated at 1,300 W of install equipment heat generation):	
c. Internal Range	Maintains 80° to 105° of internal heat conditions, maximum
d. External Range	100° $\pm$ 25°, maximum
e. Forced air unit	Required with non disposable air filter unobstructed and uninterruptible
f. Air conditioning	As required, fully internal mounted
g. Heater	As required, fully internal mounted



h. Uninterruptible power supply	As required, fully internal mounted
i. Front door	Full length, see through, EMI resistant, and lockable
j. Rear door	Full length, non-see through, EMI resistant, and lockable
k. Conduit wiring entrance	TOP AND/OR BOTTOM, FULLY SEALED
l, Input power	2 ea. minimum 120 VAC @ 20A, maximum, independent circuit, conduit for fixed or armored cable for moveable installations
m. Dimensions:	
n. Height	1980 mm (78in.), maximum
o. Width	635 mm (25in.), maximum
p. Depth	965 mm (38in.), maximum
q. Front panel opening	480 mm (19in.), w/ EIA mounting hole spacing

D. DISTRIBUTION OR SYSTEM INTERFACE CABINET: The cabinet shall be constructed of heavy 16 ga cold rolled steel, have top and side panels and hinged front and rear (front door only if wall mounted) doors.

1. It shall have baked-on iron phosphate primer and baked enamel paint finish in a color to be selected by the using FMS Chief or the COR, contain integral and adjustable predrilled rack mounting rails or frame that allows front panel equipment mounting and access.
2. When all equipment, doors and panels are installed, snap-in-place chrome trim strip covers are required to be installed that will cover all front panel screw fasteners.
3. It shall be equipped the same as the equipment cabinet.
4. Technical Characteristics

a. Overall height	2,180 mm (85 7/8in.), maximum
b. Overall depth	650 mm (25 1/2in.), maximum
c. Overall width	535 mm (21 1/16in.), maximum
d. Equipment vertical mounting space	1,960 mm (77 1/8in.), maximum
e. Front panel horizontal	484 mm (19 1/16in.), maximum width

E. STAND ALONE EQUIPMENT RACK (or sometimes called Radio Relay Rack): The rack shall be constructed of heavy 16 ga cold rolled steel and have fully adjustable equipment front mounting rails that allows front panel equipment mounting and access.

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1. It shall have baked-on iron phosphate primer and baked enamel paint finish in a color to be selected by the using FMS Chief or the COR. It shall be floor or wall mounted or mounted on casters as directed by the COR.

2. Technical Characteristics

a. Overall Height	2,180 mm (85 7/8in.), maximum
b. Overall Depth	650 mm (25 1/2in.), maximum
c. Overall Width	535 mm (21 1/16in.), maximum
d. Front Panel Opening	480 mm (19in.), EIA horizontal width
e. Hole Spacing	per EIA and Industry Standards

## F. WIRES AND CABLES

1. CONTROL WIRING: Is not required to be plenum rated when installed in conduit. It is required to be plenum rated when installed in designated "Air Plenum" spaces / areas. Wiring that is routed in cable trays via pathways that is not rated "Air Plenum" locations, the wiring is not required to be plenum rated; only when pathways pass through "Air Plenum" spaces/areas, the wiring shall be plenum rated.
  - a. Unless otherwise specified in other Specifications Sections of the TIP specifications (re SECTIONS 27 05 11, 27 11 00, 27 13 00 & 27 15 00), control wiring shall be as specified for power and lighting wiring, except the minimum size shall be not less than No. 16 AWG.
  - b. Control wiring shall be large enough so that the voltage drop under "turn-on" conditions does not adversely affect operation of the controls.
2. COMMUNICATIONS AND SIGNAL WIRING: Is not required to be plenum rated when installed in conduit. It is required to be plenum rated when installed in designated "Air Plenum" spaces / areas. Wiring that is routed in cable trays via pathways that is not rated "Air Plenum" locations, the wiring is not required to be plenum rated; only when pathways pass through "Air Plenum" spaces/areas, the wiring shall be plenum rated. The wires:
  - a. Shall conform to the recommendations of the OEMs of the communication and signal systems; however, not less than what is shown.
  - b. Shown is for typical systems. Provide wiring as required for the systems being furnished.
  - c. Multi-conductor construction shall have the conductors color coded per TIA/TIA 569.
  - d. Shall provide minimum grade of service of BICSI Category 5E. If the Facility desires enhanced grade(s) of service, it must be fully identified

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and justified at the beginning of the project, during the Project's initial design phase.

3. COPPER CONDUCTOR CABLE: Is defined as solid copper conductors, covered with an extruded solid insulating compound. Insulated conductors shall be twisted into pairs which are then stranded or oscillated to form a cylindrical core. The copper cable is not required to be plenum rated when installed in conduit. It is required to be plenum rated when installed in designated "Air Plenum" spaces / areas. Wiring that is routed in cable trays via pathways that is not rated "Air Plenum" locations, the wiring is not required to be plenum rated; only when pathways pass through "Air Plenum" spaces/areas, the wiring shall be plenum rated.
  - a. For special high frequency applications, the cable core shall be separated into compartments.
  - b. Cable shall be completed by the application of a:
    - 1) Suitable core wrapping material,
    - 2) Corrugated copper or plastic coated aluminum shield, and
    - 3) Overall extruded jacket.
  - c. The contractor shall verify distances between splice points prior to ordering cable in specific cut lengths. Gauge of conductor shall determine the range of numbers of pairs specified (ie):
    - 1) 19 gauge (6 to 400 pairs),
    - 2) 22 gauge (6 to 1,200 pairs),
    - 3) 24 gauge (6 to 2,100 pairs),
    - 4) 26 gauge (6 to 3,000 pairs).
  - d. Each copper cable shall meet or exceed the following specifications for the specific type of cable:
    - 1) Each cable reel shall be sweep tested and certified by the OEM by tags affixed to each reel. The Contractor shall turn over all sweep tags to the COR or PM. Additionally, the Contractor shall provide a 610 mm (2 ft.) sample of each provided cable, to the COR and receive approval before installation.
    - 2) Cables installed in any outside location (i.e. above ground, underground in conduit, ducts, pathways, etc.) shall be filled with a waterproofing compound between outside jacket (not immediately touching any provided armor) and inter conductors to seal punctures in the jacket and protect the conductors from moisture.

- 3) The Contractor shall provide all Systems cables that are OEM recommended and insure the approved System expansion is met.
- e. Data Multi-Conductor (Digital): The cable shall be multi-conductor, shielded or unshielded cable with stranded conductors. The cable shall be able to handle the power and voltage used over the distance required.
- 1) It shall meet BICSI Category 5e service at a minimum.
- 2) Technical Characteristics:

REQUIREMENT	FUNCTION
a) Wire size	22 AWG, minimum
b) Working shield	350 V
c) Bend radius	10X the cable outside diameter
d) Impedance	100 Ohms $\pm$ 15%, BAL
e) Bandwidth	100 mHz, minimum
F) DC RESISTANCE	10.0 Ohms/100M, maximum
g) Shield coverage	
h) Overall Outside (if OEM specified)	100%
i) Individual Pairs (if OEM specified)	100%
j) Attenuation	
<b>k) Frequency in mHz</b>	<b>dB per 305 M (1,000ft.), maximum</b>
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
62.0	52.0
100.0	68.0

- f. Remote Control: The remote control cable shall be multi-conductor with stranded (solid is permissible) conductors.
- 1) The cable shall be able to handle the power and voltage necessary to control specified system equipment from a remote location.

- 2) The cable shall be NRTL listed and pass the FR-1 vertical flame test, at a minimum.
- 3) Each conductor shall be color-coded.
- 4) Combined multi-conductor and coaxial cables are acceptable for this installation, as long as all system performance standards are met.
- 5) Technical Characteristics

REQUIREMENT	FUNCTION
a) Length	As required, in 1K (3,000 m.) reels minimum
b) Connectors	As required by system design
c) Size	18 AWG, minimum, Outside 20 AWG, minimum, Inside
d) Color coding	Required, EIA industry standard
f) Bend radius	10X the cable outside diameter
g) Impedance	As required
h) Shield coverage	As required by OEM specification
i) Attenuation	
<b>j) Frequency in MHz</b>	<b>dB per 305 M (1,000ft.), maximum</b>
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

4. FIBER OPTIC CABLE: Is not required to be plenum rated when installed in conduit. It is required to be plenum rated when installed in designated "Air Plenum" spaces / areas. Wiring that is routed in cable trays via pathways that is not rated "Air Plenum" locations, the wiring is not required to be plenum rated; only when pathways pass through "Air Plenum" spaces/areas, the wiring shall be plenum rated.

a. Single-mode

- 1) 8/125-um, 0.10 aperture 1,310 nm fiber optic cable in accordance with TIA-492CAAA,

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- 2) 8/125-um, 0.10 aperture 1,550 nm fiber optic cable in accordance with TIA-492E000.
- b. Multimode
  - 1) 62.5/125-um, Bell System Standard, 0.275 aperture fiber optic cable in accordance with TIA-492AAAA, TIA-472D000, and ICEA S-87-640, OR
  - 2) 50/125-um, American (NOT EUROPEAN) Standard, 0.275 aperture fiber optic cable that is optically enhanced in accordance with TIA-492AAAB, including any special requirements made necessary by using this specialized design (re PART 1, PARAGRAPH 1.4.E.3.h for minimum performance).
- c. Strength Members: Provide central, non-metallic strength members with sufficient tensile strength for installation and residual rated loads to meet the applicable performance requirements in accordance with ICEA S-87-640. The strength member is included to serve as a cable core foundation to reduce strain on the fibers, and shall not serve as a pulling strength member.
- d. Shielding or Other Metallic Covering: Provide copper, tape covering or shield in accordance with ICEA S-87-640.
- e. Fiber optic cable: Shall be specifically designed for inside use with loose buffered construction. Provide fiber optic color code in accordance with TIA/EIA-598.
- f. Performance Requirements: Provide fiber optic cable with optical and mechanical performance requirements in accordance with ICEA S-87-640.
  - 1) End to End Link Performance as listed in Annex E of ANSI/ TIA/ EIA SP-2840A.
  - 2) The cabling system must conform to the current issue of Industry Standard ANSI/TIA/EIA 568A.
  - 3) The system shall support all applications for which it is designed, including, at a minimum ATM 155 Mbps for BICSI Certified Category 5E (see PART 2, PARAGRAPH 2.4.C.4), during the lifetime of the certified system.
  - 4) Quality and installation methods used shall be equal to or better than that found in the BICSI TDM Manual.
  - 5) VA demands strict adherence to the performance specifications listed in ANSI/TIA/EIA SP-2840A, 568A and 569.
  - 6) New construction AND major renovations of telecommunications spaces and pathways shall conform to EIA/TIA 569, at a minimum.

- a) In cases of renovations in historic or otherwise restrictive buildings; where it has been determined as impossible to follow the above stated guidelines, the exceptions must not modify the maximum distances set forth in ANSI/TIA/EIA SP-2840A, 568A and 569 and must not in any way affect the performance of the entire cabling system.
- b) Modification to administrative issues requires written approval(s) from CFM's COR; with concurrence from the OEM, Contractor, SMCS and Using Authority(s).

G.

G. COMMON EQUIPMENT ITEMS

1. Conduits

a. Rigid galvanized steel	Shall Conform to UL 6, ANSI C80.1.
b. Rigid aluminum	Shall Conform to UL 6A, ANSI C80.5.
c. Rigid intermediate steel (IMC)	Shall Conform to UL 1242, ANSI C80.6.
d. EMT	Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed 105 mm (4 inch) and shall be permitted only with cable rated 600 volts or less.
e. Flexible galvanized steel	Shall Conform to UL 1.
f. Liquid-tight flexible metal	Shall Conform to UL 360.
g. Direct burial plastic	Shall conform to UL 651 and UL 651A, and heavy wall PVC or high density polyethylene ( <b>PE</b> ).

2. Conduit Fittings

<b>a. Rigid steel and IMC</b>	
(1) Fittings	Shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
(a) Sealing	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) 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. <b>Bushings made entirely of metal or nonmetallic material are not permitted.</b>

(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. <b>Tightening of set screws with pliers is prohibited.</b>
(6)	Must be OEM approved.
<b>b. EMT</b>	Shall meet the requirements of UL 514B and ANSI/ NEMA FB1
(1) fittings	Only steel or malleable iron materials are acceptable.
(2) 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.
(3)	Must be OEM approved.
<b>c. Flexible steel</b>	Conform to UL 514B. Only steel or malleable iron materials are acceptable.
(1) Clamp type,	Must be provided with insulated throat.
(2)	Must be OEM approved.
<b>d. Liquid-tight flexible metal</b>	Shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
(1)	Only steel or malleable iron materials are acceptable.
(2)	Must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
(3)	Must be OEM approved.
<b>e. Rigid aluminum</b>	Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. <b>Aluminum fittings containing more than 0.4 per-cent copper are prohibited.</b>
(1) Locknuts and bushings	As specified for rigid steel and IMC conduit.
(2) Set screw fittings	<b>Not permitted for use with aluminum conduit.</b>
(3) Indent type connectors or couplings	Are Prohibited.
(4) Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal"	Are prohibited.



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(5)	Must be OEM approved.
e. Direct burial plastic conduit fittings	
(1)	Fittings shall meet the requirements of UL 514C and NEMA TC3.
(2)	As recommended by the conduit OEM.
f. Expansion and deflection couplings:	
(1) Conform	To UL 467 and UL 514B.
(2) Accommodates	19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
g. 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.
h. Jacket	Must be flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

## 3. 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.

## 4. Junction, and Pull Boxes

a. Conforms	To UL-50 and UL-514A.
b. Cast metal	Where required by the NEC or shown, and equipped with rustproof boxes.
c. Sheet metal boxes	Galvanized steel, except where otherwise shown.
d. Flush mounted	Wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall or ceiling. Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.

## 5. Telecommunications Pathways and Spaces - comply with TIA/EIA-569-A.

a. Cable trays	Shall be provided and utilized in the system to manage cable in an orderly fashion. Cable management shall be installed in racks and on walls as per OEM's recommendations.
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	Appropriate fire barriers shall be placed around the cables in the sleeves, and unused sleeves shall be properly fire stop-ped.
b. Cable Duct	Equip with hinged covers, except where removable covers are allowed by specific authorization from the COR in writing.
c. Cable Duct Fittings	As recommended by the Cable Duct OEM.
d. Surface Metal Raceway	Shall conform to <b>UL 5</b> and be <b>"telecommunications service"</b> rated with approved length-way partitions and cable straps to prevent wires and cables from changing from one partitioned pathway to another.
e. Surface Metal Raceway fittings	As recommended by the Raceway OEM.
f. Wireway, Metal or Approved Plastic	Shall be <b>"telecommunications service"</b> rated with approved length way partitions and cable straps to prevent wires and cables from changing from one partitioned pathway to another.
g. Wireway, Approved "Basket"	Shall be <b>"telecommunications service"</b> rated with approved length way partitions and cable straps to prevent wires and cables from changing from one partitioned pathway to another.
h. Wireway Fittings	As recommended by the Wireway OEM.

6. Interduct

- a. Outside plant innerduct may be plenum rated where each interduct is 3" (75 mm) and larger.
- b. Inside Plant Innerduct shall be listed and marked for installation in plenum airspaces and shall be a minimum 1.0" (25mm) inside diameter.
  - 1) Plenum innerducts shall be constructed of low smoke emission, flame retardant PVC.
  - 2) All Innerducts shall be furnished with factory installed nylon pull ropes.
  - 3) Plenum innerducts shall have a UL 94 V-O rating for flame spreading limitation.
  - 4) All innerduct reel lengths shall be provided as necessary to insure that ducts are continuous; one piece runs from ENT to MH; MH to MH; DEMARC to MCR/TER; TR to TR. No innerduct connectors will be allowed between rooms.
  - 5) Pulling accessories used for innerduct shall be compatible with materials being pulled. Accessories shall be furnished as required to complete the installation, including but not limited to, inner duct

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lubricants, spreaders, applicators, grips, swivels, harnesses, and line missiles (aka blown air).

- 6) Each segment of innerduct shall extend at least 12.0" (300mm) inches beyond the end of the service conduit tie and/or cable tray. Innerduct ends shall be neatly restrained with wall mount clamps and sealed when cable is installed.

#### H. WIRE LUBRICATING COMPOUND

1. Suitable for the wire insulation and conduit it is used, and shall not harden or become adhesive.
2. Shall not be used on wire for isolated type electrical power systems.
3. SHALL BE USED ONLY AT THE OEM'S DIRECTON FOR NURSE CALL, PA, FA, SECURITY MANAGEMENT AND OTHER LIKE EMERGENCY SYSTEMS.

### 2.5 WIRE MANAGEMENT SYSTEM AND EQUIPMENT

A. Wire Management System: The system(s) shall be provided as the management center of the respective cable system: TER, MCR, TR, HE, SCR, ECC, EMCC, etc. It shall perform as a platform to house peripheral equipment in a standard relay rack(s), equipment, distribution, interface cabinet(s) and wall mounting boards, panels or rails. It shall be arranged in a manner as to provide convenient access to all installed Facilities Management Service (FMS), OI&T and other equipment.

1. All cables and connections shall be at the rear and/or top of each system interface to conduits, patch panels, punch blocks, wire wrap strips, barrier strip, etc.
2. Each system shall be custom configured to meet the System design and user needs. The MIN required is a rack, cabinet, or wall mounted TIA/EIA 19" wide and two RUs high.

B. Wire Management Equipment - the wire management equipment shall be the focal point of each wire management system. It shall provide an orderly interface between outside and inside wires and cables (where used), distribution and interface wires and cables, inter-connection wires and cables and associated equipment, jumper cables, and provide a uniform connection media for all system fire retardant wires and cables and other subsystems.

1. It shall be fully compatible and interface to each cable tray, duct, pathway, wireway, or conduit used in the system.
2. All interconnection or distribution wires and cables shall enter the system at the top (or from a wireway in the floor) via a over-head protection system and be uniformly routed down either side (or both at the same time) of the

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frames side protection system then laterally via a anchoring or routing shelf for termination on the rear of each respective terminating assembly.

<b>a. Vertical Cable Management</b>	Required, 4" X 5" duct style MIN, mounts to side or between 19" equipment racks, mounts in the front or rear of equipment racks or cabinets, contains cover to protect cables, has slots on each side for cable ingress and egress.
(1) Wall Brackets	Required - 19" wide and 6" deep MIN, accepts and mounts standard TIA/EIA 19" wide patch panels, mounting blocks, etc., hinged on one side to allow rear cable access.
(2) Floor Frames	Required - in very high density cable locations (ie PBX, TER, TR, MCR rooms), single or double sided metal construction, bold mountable for floor applications, compatible for 300 pair, 66, 110 or 110A blocks, maintains MIN 6" high vertical cable channels, prevents opens, crosses or shorts in cables attached to it
<b>b. Horizontal Cable Management</b>	
(1) Combination Organizers	TIA/EIA minimum Category 5E, 19" rack width, in one RU (1.75") multiples to suite system design, front and rear cable routing rings required, six MIN.
(2) Cable Bars	
(a) Flat type	Required - 19" rack width rear or front cabinet or rack mount-able, contains cable tie bars and/or wire saddles.
(b) Duct type	Required - 19" rack width rear (1" X 4" MIN) or front (1 ½" X 3" MIN) cabinet or rack mount-able; alternate 2" X 4" MIN rear and 3" X 3" front MIN ducts are allowed, each duct in multiple of 1.0 RU (1.75") height.
(3) Cable Hangers	<u>ALLOWED TO SUPPLEMENT CONDUIT RUNS - DO NOT USE FOR EMERGENCY/ LIFE &amp; PUBLIC SAFETY/ CRITICAL SERVICE COMMUNICATION CABLES - THESE ARE REQUIRED TO BE IN CONDUIT.</u>
(a) Wall Mountable	<u>WHEN APPROVED</u> - in open cable runs, 3" X 2.5" 2.5" MIN, wall or ceiling mountable, allows cables to be installed and re-moved from hanger, black color metal or high impact plastic construction MIN required.
(b) Bar Type	<u>WHEN APPROVED</u> - in open cable runs shall be compliment TO AC-CESS Type 66, 110 OR 110A block cable loops; screw mountable required.

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(c) Rack Mountable	Required - above and or inside 19" cabinet panels where wire looms are not provided, allows quick cable attachment or removal, screw mountable.
(4) "J" Hooks & "O" Rings or "S" Clips	<b><u>ALLOWED ONLY FOR CONDUIT - DO NOT USE FOR ANY EMERGENCY/LIFE &amp; PUBLIC SAFETY/CRITICAL SERVICE COMMUNICATION CABLES - THESE ARE REQUIRED TO BE IN CONDUIT.</u></b>  <b><u>WHEN APPROVED</u></b> - in open CONDUIT runs, screw mountable only, 1.5" X 2" MIN, each ITEM shall support a MIN of ONE 1.0" CONDUIT..
(5) Cable Ladder	<b><u>WHEN APPROVED</u></b> - shall nominally be 12 in. (305 mm) wide, rung spacing of 9" (225 mm) and be certified / listed for telecommunications service.
(6) Cable Support	NRTL labeled for support of minimum Category 5E cabling, designed to prevent degradation of cable performance and pin - points that could damage cable.
<b>c. Vertical or Horizontal Cable Management</b>	
(1) Cable Ties	Required - 4" MIN length, black in color, ultraviolet resistant.
(2) Cable Tie Mounting De-vices	
(a) Adhesive Backed	Required - square style 0.5" X 0.5" MIN, allows two MAX cable ties to be attached in either direction, attaches directly to metal or slick surfaces, re-quires additional screw when mounted to wood or wall back-board.
(b) Screw Type	Required - rectangle style 0.5" X 0.75" MIN, allows one cable tie to be attached in only one direction, requires wood or dry-wall screw for wall or backboard mounting or sheet metal screw for metal mounting.
(c) Screw Anchor Type	Required - rectangle style 0.5 X 0.75" MIN with mounting hole on one end, allows one cable to be attached in only one direction, requires wood or drywall screw for wall or backboard mounting or sheet metal screw for metal mounting.
(3) Cable Clips	<b><u>WHEN APPROVED</u></b> - in open CONDUIT runs, nail able or screw mount-able designed with arch to fit CONDUIT diameter without damageing the CONDUIT; plastic white or black color allowed.
(7) Wire Spools	<b><u>WHEN APPROVED</u></b> - in open cable runs, round in design with flange on outside to prevent cables from falling off spool, screw mountable via center of spool

(8) Spiral Cable Wrapping	Required - when cable ties are not used to secure all cables, 0.5" OD MIN, weather proof Polyethylene construction MIN required, neatly bonds all loose cables in one bundle without damaging cables, allows cable to ingress and egress from the bundle through the wraps.
(9) Wire Clips and Clamps	Required - when cable ties are not used on short runs, adhesive backed, requires screw mounting to wall or back boards OR metal.
(10) Support Brackets	Provided with cable tie slots for fastening cable ties to Lacing Bars / Brackets.

## 2.6 ENVIRONMENTAL REQUIREMENTS:

- A. Technical submittals shall identify the environmental specifications for housing the system. These environmental specifications shall identify the requirements for initial and expanded system configurations for:
- B. Floor loading for batteries and cabinets.
- C. Minimum floor space and ceiling heights.
- D. Minimum size of doors for equipment passage.
- E. Power requirements: The bidders shall provide the specific voltage, amperage, phases, and quantities of circuits required.
- F. Air conditioning, heating, and humidity requirements. The Contractor shall identify the ambient temperature and relative humidity operating ranges required preventing equipment damage.
- G. Air conditioning requirements (expressed in BTU per hour, based on adequate dissipation of generated heat to maintain required room and equipment standards).
- H. Proposed floor plan based on the expanded system configuration of the Contractor's proposed PBX (if used) for this Facility.
- I. Conduit size requirement (between equipment room and console room).

## 2.7 INSTALLATION KIT:

- A. The kit(s) shall be provided that, at a MIN, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks, wiring blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire terminal or wiring block.
- B. Unfinished or unlabeled wire connections shall not be allowed and the system will not be accepted if these types of practices are used.

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- C. All unused partially opened installation kit boxes, coaxial cable reels, conduit, cable tray, and /or cable duct bundles, wire rolls, and physical installation hardware shall be turned over to the COR. THIS IS NOT AN ACCEPTABLE ALTERNATE TO THE INDIVIDUAL SPARE EQUIPMENT UNLESS the MIN spare items are provided in these counts meets the levels described herein.
- D. The MIN required installation kits are as follows:

<b>FUNCTIONS</b>	<b>CHARACTERISTICS</b>
1. System Grounding	The grounding kit shall include all cable and installation hardware required. All radio equipment shall be connected to earth ground via internal building wiring, according to the NEC. This includes, but is not limited to:
a. Coaxial Cable Shields and Center Conductor	Only use the Building's Outside Lightning Grounding System.
b. Coaxial / System Cable Lightning Protectors	Only use the Building's Outside Lightning Grounding System.
c. Control Cable Shields	Only use the Building's Inside Signal Grounding System.
d. Data Cable Shields	Only use the Building's Inside Signal Grounding System.
e. Equipment Racks	Only use the Building's Inside Signal Grounding System.
f. Equipment Cabinets	Only use the Building's Inside Signal Grounding System.
g. Conduits	Only use the Building's Inside Signal Grounding System.
h. Cable Duct	Only use the Building's Inside Signal Grounding System.
i. Cable Trays	Only use the Building's Inside Signal Grounding System.
j. Power Panels	Only use the Building's Inside Signal Grounding System
k. Connector Panels	Only use the Building's Inside Signal Grounding System
2. COAXIAL CABLES	The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.
3. WIRE AND CABLES	The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, wiring blocks, wire wrap strips, heat shrink tubing, tie wraps, solder,

	hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
4. CONDUIT, CABLE DUCT AND CABLE TRAY	The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.
5. EQUIPMENT INTERFACE	The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface systems and sub-systems according to the OEM requirements and this document.
6. LABELS / LABELING	The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to completely and correctly label each sub-system according to the OEM requirements, record drawings, and this document - see Labeling Kit, Part 2, Section 2.8.
7. WIRE MANAGEMENT	The wire management kit shall include any item (i.e. cable wrap, guides, hangers, holders, forms, etc.) in sufficient quantity to provide a neat and orderly wire and cable installation between and inside all system components.
8. DOCUMENTATION	The documentation requirement of the Installation Kit shall include any item or quantity of items, computer discs, record drawings, equipment, maintenance, and operation manuals, and OEM materials needed to completely and correctly provide the system documentation as required by this specification document and explained herein.

## 2.8 LABELING

- A. Labels: Provide labeling for equipment, new cabling and termination hardware located within the Facility in accordance with TIA/EIA-606. Handwritten labeling is unacceptable. Stenciled lettering for cable and termination hardware shall be provided using (thermal ink transfer process) (laser printer) (other \_\_\_\_\_).
1. Cable Tag Installation: Install cable tags for each TIP cable or wire located in manholes, handholes, and vaults including each splice. Tag new wire and cable provided under this contract and existing wire and cable which are indicated to have splices and terminations provided by this contract. The labeling of TIP cable tag identifiers shall be in accordance with TIA/EIA-606. Do not provide handwritten letters. Install cable tags so that they are



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clearly visible without disturbing any cabling or wiring in the manholes, handholes, and vaults.

2. Equipment Labels: System equipment shall be permanently labeled with contrasting plastic laminate or Bakelite material. System equipment shall be labeled on the face of the unit corresponding to its source. Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two (2) sheet-metal screws or two (2) rivets (Alternates to the nameplates will be considered during the technical submittal approval process).
  3. Clearly, consistently, logically and permanently mark switches, connectors, jacks, relays, receptacles and electronic and other equipment.
  4. Engrave and paint fill all receptacle panels using 1/8" (minimum) high lettering and contrasting paint.
  5. For rack-mounted equipment, use engraved Lamacoid labels with white 1/8" (minimum) high lettering on black background. Label the front and back of all rack-mounted equipment.
  6. Where multiple pieces of equipment reside in the same rack group, clearly and logically label each indicating to which room, channel, receptacle location, etc. they correspond.
  7. Permanently label cables at each end, including intra-rack connections. Labels shall be covered by the same, transparent heat-shrink tubing covering the end of the overall jacket. Alternatively, computer generated labels of the type which include a clear protective wrap may be used.
  8. Contractor's name shall appear no more than once on each continuous set of racks. The Contractor's name shall not appear on wall plates or portable equipment.
- B. Ensure each OEM supplied item of equipment has appropriate NRTL (aka UL) Labels / Marks for the service the equipment is performed permanently attached / marked. EQUIPMENT INSTALLED NOT BEARING THESE MARKS WILL NOT BE ALLOWED TO BE A PART OF THE SYSTEM. THE CONTRACTOR SHALL BEAR ALL COSTS REQUIRED TO PROVIDE REPLACEMENT EQUIPMENT WITH APPROVED UL MARKS.

## **2.9 COMMUNICATIONS SYSTEM GROUND:**

- A. In addition to the requirements outlined in SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS, the contractor shall provide a circulating system "Signal Ground" that is separate from other Facility grounding systems (i.e. electrical, lightning, building, etc.) as described herein.

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- B. Proper communications system grounding and bonding shall be provided for each: SPDP of Presence, ENTR (DEMARC), TER, TOR, MCR, MCOR, PCR, SCC, ECR, EMCR, STR(s), HER, TRs, TCOs; and insure all internal telecommunications equipments installed in these areas are connected to it as described herein.
- C. Reference shall be made to proper codes and standards, such that all grounding systems must comply with all applicable National, Regional, and Local Building and Electrical codes. The most stringent code of these governing bodies shall apply.
- D. Technical Characteristics

1. Connectors	Enclosed Circular Coated, Sealed and Plated Copper MIN #0 AWG Lug, or as specified by the COR
2. Wire	Stranded Copper # 0 AWG (minimum) with protective jacket, or as specified by the COR

**2.10 LIGHTNING PROTECTION SYSTEM/GROUND:**

- A. In addition to SECTION 26 41 00 - FACILITY LIGHTNING PROTECTION requirements, the contractor shall provide a lightning protection connection system for the communications systems / circuits totally and externally to the building. The use of internal electrical or signal grounding systems is not acceptable and will not be approved. The Contractor shall provide this system if it is not previously provided as a part of the contract.
- B. System Building Inputs, Aerial Cables and Underground Cables: These locations and equipment items shall be grounded with copper wire run external to the building and connected to the earth ground. If the location and/or equipment item is to be installed in an area not protected by lightning rods or if the location and / or equipment item is to be elevated above existing lightning rod protection, the Contractor shall immediately notify the COR in writing regarding the lightning strike hazard.
- C. Technical Characteristics

1. Connections	To the Facility's Lightning Protection System as required by the COR ( <b>if no Facility system is present - the contractor shall provide a separate Minimum #0 AWG stranded copper wire grounding cable secured and connected outside of the building to the earth as specified by the COR</b> )
2. Connectors	Enclosed Circular Coated, Sealed and Plated Copper Minimum #0 AWG Lug, or as specified by the COR
3. Signal Wire/ Cable	Provided according to the OEM's recommendations for the specific cable,

Grounding Protectors	circuit or system's wires and cables. Each protector shall be connected to the lightning protection system as aforementioned.
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D. System Building Inputs, Aerial Cables and Underground Cables: These locations and equipment items shall be grounded with copper wire run external to the building and connected to the earth ground. If the location and/or equipment item is to be installed in an area not protected by lightning rods or if the location and / or equipment item is to be elevated above existing lightning rod protection, the Contractor shall immediately notify the COR in writing regarding the lightning strike hazard.

E. Technical Characteristics

Connections	To the Facility's Lightning Protection System as required by the COR (if no Facility system is present - the contractor shall provide a separate Minimum #0 AWG stranded copper wire grounding cable secured and <b>connected outside of the building</b> to the earth as specified by the COR)
Connectors	Enclosed Circular Coated, Sealed and Plated Copper Minimum #0 AWG Lug, or as specified by the COR
Grounding Protectors	Provided according to the OEM's recommendations for the specific cable, circuit or system's wires and cables. Each protector shall be connected to the lightning protection system as aforementioned.

**PART 3 - EXECUTION**

**3.1 INSTALLATION:**

A. The Contractor shall use the criteria and requirements of this PART to complete the detailed installation of the System. The Design shall include computer RF modeling and site surveys as described herein. The Contractor shall be able to show design RF signal level(s) to sub-room precision for all room(s) /area(s) within the approved defined coverage area(s). The COR shall provide the Contractor with compatible drawings from the project Architect. If the drawings are within BIM then it is the responsibility of the Contractor to modify the BIM Model for use in their wireless modeling which shall include, at a minimum, the creation of 2-D Floor Plans, Reflected Ceiling Plans (RCP) and elevations.

B. GENERAL SYSTEM INSTALLATION

1. After the contract's been awarded, and within the time period specified in the contract, the Contractor shall deliver the total system in a manner that fully complies with the requirements of this specification. The Contractor

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shall make no substitutions or changes in the System without written approval from the COR and PM.

2. The Contractor shall install all equipment and systems in a manner that complies with accepted industry standards of good practice, OEM instructions, the requirements of this specification, and in a manner which does not constitute a safety hazard. The Contractor shall insure that all installation personnel understands and complies with all the requirements of this specification.
3. The Contractor shall provide written verification to the COR at time of installation, that the type of wire/cable being provided is recommended and approved by the OEM. The Contractor is responsible for providing the proper size and type of cable duct and/or conduit and wiring even though the actual installation may be by another subcontractor.
4. Active electronic component equipment shall consist of solid state components, be rated for continuous duty service, comply with the requirements of FCC and NRTL standards for DAS equipment, systems, and service.
5. All passive distribution equipment shall meet or exceed -80 dB radiation shielding specifications.
6. All passive equipment shall be connected according to the OEM's specifications to insure future correct termination, isolation, impedance match, and signal level balance at each telephone/data outlet.
7. The Contractor shall install suitable filters, traps, directional couplers, splitters, TR's, and pads for minimizing interference and for balancing the System. Items used for balancing and minimizing interference shall be able to pass DAS control, Lightwave (fiber optic) , RF, signals in the frequency bands selected, in the direction specified, with low loss, and high isolation, and with minimal delay of specified frequencies and signals. The Contractor shall provide all equipment necessary to meet the requirements outlined herein and the System performance standards.
8. Noise filters and surge protectors shall be provided for each equipment interface cabinet, switch equipment cabinet, control console, local, and remote active equipment locations to ensure protection from input primary AC power surges and noise glitches are not induced into low Voltage data circuits.
9. Where TCOs are installed adjacent to each other, install one outlet for each instrument.

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10. All lines shall be terminated in a suitable manner to facilitate future expansion of the System as described (re 50% and expansion information) described in PART 2.
11. Equipment installed indoors shall be installed in metal cabinets with hinged doors and locks with two matching keys (NOTE ALL CABINET LOCKS SHALL BE VENDING MACHINE TYPE LOCKS LIKE KEYED WITH OUTDOOR CABINETS).
12. All interconnecting twisted pair, fiberoptic or coaxial cables shall be terminated on equipment terminal boards, punch blocks, breakout boxes, splice blocks, and unused equipment ports/taps shall be terminated according to the OEM's instructions for telephone cable systems without adapters. The Contractor shall not leave unused or spare twisted pair wire, fiberoptic, or coaxial cable unterminated, unconnected, loose or unsecured
13. Color code all distribution wiring to conform to the Telephone Industry standard, EIA/TIA, and this document, whichever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and permanently labeled according to and using the provided record drawings, to facilitate installation and maintenance.
14. Connect the System's primary input AC power to the Facility' Critical Branch of the Emergency AC power distribution system as shown on the plans or if not shown on the plans consult with COR regarding a suitable circuit location prior to bidding.
15. Plug-in connectors shall be provided to connect all equipment, except coaxial cables and interface points. Coaxial cable distribution points and RF transmission lines shall use coaxial cable connections recommended by the cable OEM and approved by the System OEM. Base-band cable systems shall utilize barrier terminal screw type connectors, at a minimum. Crimp type connectors installed with a ratchet type installation tool are and acceptable alternate as long as the cable dress, pairs, shielding, grounding, and connections and labeling are provided the same as the barrier terminal strip connectors. Tape of any type, wire nuts, or solder type connections are unacceptable and will not be approved.
16. All equipment faceplates utilized in the System shall be stainless steel, anodized aluminum, or UL approved cyclac plastic for the areas where provided.

#### B. CONDUIT AND SIGNAL DUCTS

1. Conduit

- a. The Contractor shall employ the latest installation practices and materials. The Contractor shall provide conduit, junction boxes, connectors, sleeves, weather heads, pitch pockets, and associated sealing materials not specifically identified in this document as GFE. Conduit penetrations of walls, ceilings, floors, interstitial space, fire barriers, etc., shall be sleeved and sealed. The minimum conduit size shall be as described herein.
- b. All telecommunications emergency, critical, life support and safety cables shall be installed in separate conduit and/or signal ducts (exception from the separate conduit requirement to allow telecommunications cables to be installed in telecommunications approved partitioned cable tray may be granted in writing by the COR if requested). The determination as to which SECTION 27 & 28 SYSTEM ARE RATED FOR EMERGENCY SERVICE CAN BE FOUND IN PART 1 OF THIS DOCUMENT. Conduits shall be provided as described herein and in accordance with Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and NEC Articles 517 for Critical Care and 800 for Communications systems, at a minimum.
- c. When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
- d. When "innerduct" flexible cable protective systems is specifically authorized to be provided for use in the System, it's installation guidelines and standards shall be as the specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
- e. Conduit (including GFE) fill shall not exceed 40%. Each conduit end shall be equipped with a protective insulator or sleeve to cover the conduit end, connection nut or clamp, to protect the wire or cable during installation and remaining in the conduit. Electrical power conduit shall be installed in accordance with the NEC. AC power conduit shall be run separate from communications conduit.
- f. Ensure that Critical Care Nurse Call, PA, DAS, Radio Paging, Police Two-Way Radio, Police Security Management, Emergency and Safety Systems (as identified by NEC Section 517 & 800; and UL) are completely separated and mechanically protected from all other systems by conduit and approved telecommunications partitioned cable tray or baskets.

## 2. Signal Duct, Cable Duct, or Cable Tray

- a. The Contractor shall use existing conduit, signal duct, cable duct, and/or cable tray, when identified and approved by the COR.
- b. Approved signal and/or cable duct shall be a minimum size of 100 mm x 100 mm (4 in. X 4 in.) inside diameter with removable tops or sides, as appropriate. Protective sleeves, guides or barriers are required on all sharp corners, openings, anchors, bolts or screw ends, junction, interface and connection points.
- c. Approved cable tray shall be fully covered, mechanically and physically telecommunications approved partitioned for multiple electronic circuits use, and be NRTL listed and labeled for use with telecommunication circuits and/or systems. The COR shall approve width and height dimensions.

C. CONNECTORS: Circuits, transmission lines, and signal extensions shall have continuity, correct connection and polarity. A uniform polarity shall be maintained between all points in the system.

## 1. Wires:

- a. Wire ends shall be neatly formed and where insulation has been cut, heat shrink tubing shall be employed to secure the insulation on each wire. Tape of any type is not acceptable.
- b. Audio spade lugs shall be installed on each wire (including spare or unused) end and connect to screw terminals of appropriate size barrier strips.
- c. AC barrier strips shall be provided with a protective cover to prevent accidental contact with wires carrying live AC current.
- d. Punch blocks are approved for signal, not AC wires.
- e. Wire Nut or "Scotch Lock" connectors are not acceptable for signal wire installation.

2. Cables: Each connector shall be designed for the specific size cable being used and installed with the OEM's approved installation tool. Typical system cable connectors include; but, are not limited to: Audio spade lug, punch block, wire wrap, etc.

3. Line or Microphone Audio: Each connector shall be installed according to the cable or connector OEM's instructions and use the OEM's approved installation tool. Install the connector's to provide and maintain the following audio signal polarity:

- a. XLR type connectors Signal or positive conductor is pin 3; common or neutral conductor is pin 2; ground conductor is pin 1.
  - b. Two and 3 conductor 1/4" Signal or positive conductor is tip; neutral or 1/8" Phono plugs conductor is ring and ground or shield and jacks conductor is sleeve.
  - c. RCA Phono Plugs the Signal or positive conductor is tip; and Jacks neutral or shield conductor is sleeve.
4. Speaker Line Audio:
- a. Each connector shall be installed according to the cable, transformer or speaker OEM instructions and using the OEM's approved installation tool. The Contractor shall ensure each speaker is properly phased and connected in the same manner throughout the System using two conductor type wires.
  - b. One of the conductors shall be color coded to aid in establishing speaker signal polarity. Each speaker line shall be permanently soldered or audio spade lug connected to each appropriate speaker or line matching transformer connection terminal. Speaker line connection to each audio amplifier shall use audio spade lugs, as described herein.
- D. AC POWER: AC power wiring shall be run separately from communications cable.
- E. GROUNDING (SEE PARAGRAPH 2.9 HEREIN FOR THIS REQUIREMENT)
- F. EQUIPMENT ASSEMBLY
- 1. Cabinets: Each cabinet/enclosure shall be: floor or wall mounted with standard knockout holes for conduit connections or cable entrance; provide for ventilation of the equipment; have front and rear locking doors (except wall mounted cabinets that require only a front locking door); power outlet strip(s), and connector or patch panel(s).
  - a. Rack (including freestanding radio relay) mounted equipment shall be installed in the enclosure's equipment adjustable mounting rails with equipment normally requiring adjustment or observation mounted so operational adjustment(s) can be conveniently made.
    - 1) Heavy equipment shall be mounted with rack slides or rails allowing servicing from the front of the enclosure. Heavy equipment shall not depend only upon front panel mounting screws for support.
    - 2) Equipment shall be provided with sufficient cable slack to permit servicing by removal of the installed equipment from the front of the enclosure.



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- 3) A color matched blank panel (spacer) of 44 mm (1.75 in.) high, shall be installed between each piece of equipment (active or passive) to insure adequate air circulation.
  - 4) The enclosure shall be designed for efficient equipment cooling and air ventilation. Each console or cabinet shall be equipped with a quiet fan and non-disposable air filter.
  - b. Enclosures and racks shall be installed plumb and square. Each shall be permanently attached to the building structure and held firmly in place. Fifteen inches of front vertical space opening shall be provided for additional equipment.
  - c. Signal connector, patch, and bulkhead panels (i.e.: audio, data, control, analog video, etc.) shall be connected so that outputs from each source, device or system component shall enter the panel at the top row of jacks, beginning left to right as viewed from the front, which will be called "inputs". Each connection to a load, device or system component shall exit the panel at the bottom row of jacks, beginning left to right as viewed from the front, which will be called "outputs".
  - d. Equipment located indoors shall be installed in metal racks or enclosures with hinged doors to allow access for maintenance without causing interference to other nearby equipment.
  - e. Cables shall enter the equipment racks or enclosures in such a manner that allows all doors or access panels to open and close without disturbing or damaging the cables.
  - f. All distribution hardware shall be securely mounted in a manner that allows access to the connections for testing and provides sufficient room for the doors or access panels to open and close without disturbing the cables.
2. UPS: It is acceptable to power all TER, MCR, TR & STRs FMS Equipment from single battery backup system, in lieu of individual cabinet mounted UPS, as long as the system performance standards are met.
    - a. If this option is used it is acceptable to provide one AC input surge protector to isolate the battery backup system from the Facility's Emergency AC Generator Circuit as long as it is properly sized and the system performance standards are met; AND has electrical supervision provided as described herein.

G. LABELING/LABELS (SEE PARAGRAPH 2.8 HEREIN FOR THIS REQUIREMENT)

H. LIGHTNING PROTECTION SYSTEM (SEE PARAGRAPH 2.10 HEREIN FOR THIS REQUIREMENT)

**3.2 TESTS**

- A. INTERIM INSPECTION: At approximately 40-50% of installation at the direction of the CFM COR (Additional inspection(s) may be required at the direction of the CFM COR):
1. This inspection shall verify the equipment and system being provided adheres to the installation and technical requirements of this document.
    - a. The interim inspection will be conducted by an OEM and factory-certified contractor representative; AND witnessed by a CFM COR Staff Member(s), Facility AND SMCS 0050P2H3 Representatives.
    - b. Each item of installed equipment shall be checked to insure appropriate NRTL (UL) listing labels and markings are in place.
    - c. This inspection shall verify cabling terminations are in compliance with ANSI/EIA/TIA standards.
    - d.
  2. The entire communications circulating ground system and each TGB, the separate earth ground point and lightning protection system shall be reviewed.
  3. Cable tray, conduit and path/wire-way installation practice shall be reviewed.
  4. Perform fiber optical cable 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.
  5. The Contractor shall notify the COR, in writing, of the estimated date the Contractor expects to be ready for the interim inspection, at least 20 working days before the requested inspection start date.
  6. Results of the interim inspection shall be provided to the CFM COR.
    - a. If major or multiple deficiencies are discovered, a second interim inspection may be required before permitting the Contractor to continue with the system installation until the present deficiency(s) are corrected.
    - b. The COR shall determine if an additional inspection(s) is/are required: OR if the Contractor will be allowed to proceed with the installation.
    - c. In either case, re-inspection of the deficiency(s) noted during the interim inspection(s), will be part of the proof of performance test final acceptance test.

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- d. The interim inspection shall not affect the Systems' completion date unless directed by the CFM COR.
  - e. The Facility Contracting Officer shall ensure all test documents become a part of the Systems' documentation.
- B. PRETESTING: Upon completing the installation of the System, the Contractor shall align and balance the system. The Contractor shall pretest the entire system.
- 1. Pretesting Procedure:
    - a. During the system pretest, the Contractor shall verify (utilizing the approved spectrum analyzer and test equipment) that the System is fully operational and meets all the system performance requirements of this standard.
    - b. The Contractor shall pretest and verify that all System functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. The Contractor shall measure and record the aural carrier levels of each system DAS and data channel.
  - 2. The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the System is ready for the formal acceptance test shall be submitted to the COR.
- C. ACCEPTANCE TEST: 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 date and give the COR 30 days written notice prior to the date the acceptance test is expected to begin.
- 1. The System shall be tested in the presence of a Government Representative, SMCS 0050P2H3 and an OEM certified representative. The System shall be tested utilizing the approved test equipment to certify proof of performance and Life Safety compliance.
  - 2. The System shall be tested to certify proof of performance and FCC 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.
  - 3. The acceptance test shall be performed on a "go-no-go" basis. Only those contractor minor adjustments required to show proof of performance shall be allowed.
    - a. The test shall demonstrate and verify that the installed System does comply with all requirements of this specification under operating conditions.

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- b. The System shall be rated as either acceptable or unacceptable at the conclusion of the test.
  - c. Failure of any part of the System that precludes completion of system testing, and which cannot be repaired in four (4) hours, shall be cause for terminating the acceptance test of the System. Repeated failures that result in a cumulative time of eight (8) hours to affect repairs shall cause the entire System to be declared unacceptable.
4. If it is determined the system will require retesting, System Retest shall be rescheduled at the convenience of the Government and all costs borne by the Contractor at the direction of the SRE.

D. Acceptance Test Procedure

1. Physical and Mechanical Inspection

- a. The Government Representative(s) and SMCS 0050P2H3 will tour all major areas where the System is and all sub-systems are completely and properly installed to insure they are operationally ready for proof of performance testing. A system inventory including available spare parts will be taken at this time. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed.
- b. The System diagrams, record drawings, equipment manuals, Telecommunications Infrastructure Plant (TIP) Auto CAD Disks, intermediate, and pretest results shall be formally inventoried and reviewed.
- c. Failure of the System to meet the installation requirements of this specification shall be grounds for terminating all testing.

2. Operational Test

- a. After the Physical and Mechanical Inspection of each DAS location listed in 3.2.D.1, terminating, mounting and interface equipment shall be checked to verify that it meets all FCC requirements outlined herein. A spectrum analyzer shall be utilized to accomplish this requirement.
- b. The DAS Cable distribution system shall be checked at each interface, junction, and distribution point to insure all meets the standards outlined herein.
- c. Each DAS location shall be functionally tested at the same time utilizing the Spectrum Analyzer.
- d. Once these tests have been completed, each installed DAS sub-system function shall be tested as a unified, functioning and fully operating system.

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3. Individual Item Test: The VACO SMCS 0050P2H3 Government Representative will select individual items of DAS equipment for detailed proof of performance testing until 100% of the System has been tested and found to meet the contents of this specification. Each DAS item shall meet or exceed the minimum requirements of this document
- E. Test Conclusion: (see Part 1.13.A.3 for VA "Conditions of Acceptance"): At the conclusion of the Acceptance Test, using the generated punch list (or discrepancy list) the VA and the Contractor shall jointly agree to the results of the test, and reschedule testing on deficiencies and shortages with the COR. Any retesting to comply with these specifications will be done at the Contractor's expense.
1. Please refer to PART 1, PARAGRAPH 1.13 VA ACCEPANCE OF SYSTEM MOU, CONTRACTORS WARRANTY / GUARANTEE: SUB-PARAGRAPH 1.13.A.3 for VA Conditions of System Acceptance.
  2. If the System is declared unacceptable without conditions, all rescheduled testing expenses will be borne by the Contractor.
- F. CONNECTING TO THE IWS / DAS SYSTEM
1. The Contractor shall manage and collect all FCC License / Listings and provide them to the COR and VAMC Chief of FMS when VA's accepts the System.
  2. MANAGE EACH WSP'S CONNECTION TO THE SYSTEM: The Contractor shall represent the VAMC during negotiations with each WSP, insure all VA / GSA Land Management and Conditional Use Permits / Agreements are completed and approved by VA (VA Chief of FMS will provide appropriate forms), coordinate site preparation, assist with each WSPs' installation, and coordinate connection of each WSP to the System. Each WSP's integration to the System, shall be turn-key and shall include BDS(s), donor antenna(s), installation materials/equipment, wire management and updated system drawings.
  3. MANAGE EACH VAMNC CONNECTION(s) TO THE SYSTEM: The Contractor shall coordinate site preparation, assist with each pre approved FMS installation, and coordinate connection of each FMS radio / wireless system to the System. Each FMS integration to the System, shall be turn-key and shall include BDS(s), donor antenna(s), installation materials/equipment, wire management and updated system drawings.
  4. MANAGE ADDITIONAL SERVICE CONNECTION(S) TO THE SYSTEM: The Contractor shall represent the VAMC during negotiations with each Service, insure all VA / GSA Land Management and Conditional Use Permits / Agreements are completed and approved by VA (VA Chief of FMS will provide appropriate forms), coordinate

site preparation, assist with the Service installation, and coordinate connection of each Service to the System. Each Service integration to the system, shall be turn-key and shall include BDS(s), donor antenna(s), installation materials/equipment, wire management and updated system drawings.

**3.3 TRAINING: IN ADDITION TO THE TRAINING PROVIDED IN ACCORDANCE WITH ARTICLE, INSTRUCTIONS, OF SECTION 01 00 00, GENERAL REQUIREMENTS):**

- A. Furnish the services of a factory-trained engineer or technician for a total of two (2) each four (4) hour classes to instruct designated Facility personnel. Instruction shall include cross connection, corrective, and preventive maintenance of the System and equipment.
- B. Before the System can be accepted by the VA, this training must be accomplished. Training will be scheduled at the convenience of the Facilities Contracting Officer and Chief of Engineering Service.
- C. Training shall be provided for the particular equipment(s) or system(s) as required in each associated specification and described as follows:
  - 1. 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.
  - 2. Provide thorough training of all staff assigned to those units receiving new DAS (other) communications equipment(s) and system(s). A separate training room will be set up that allows this type of individualized training utilizing in-service training unit, prior to opening of the new Facility //or cut over of the new system//.
  - 3. Provide the following minimum training times and durations:
    - a. Four (4) Weeks prior to the Facility opening for Engineering Staff (in 8-hour increments) - split evenly over 3 weeks and day and night shifts. Coordinate schedule with the COR and Facility Manager (aka Chief of FMS).
    - b. One (1) Week prior to the Facility opening for IT Staff (in 8-hour increments) - both day and night shifts. Coordinate schedule with the COR and IT Staff Supervisor or Manager.
    - c. During the Facility opening four (4) hours for supervisors and system administrators. Coordinate schedule(s) with the Facility's Chief of Staff (CoF) or other CoF designated individual(s).

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