

**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 structures, and furnish labor and materials and perform work for purchasing and installing equipment drawings and specifications.
- B. Visits to the site by Bidders may be made only by appointment with the Contracting Officers Representative (COR).
- C. 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.
- D. Prior to commencing work, general contractor shall provide proof that a OSHA certified "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present.
- E. Training:
  - 1. All employees of general contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA CP with input from the ICRA team.
  - 2. Submit training records of all such employees for approval before the start of work.

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

- A. ITEM I, GENERAL EQUIPMENT PURCHASE AND INSTALL: Emergency Generator, ATS and concrete pads at the water treatment plant (WTP). Work includes general construction, alterations, electrical work, utility systems, necessary removal of existing structures and construction and certain other items.

**1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR**

- A. AFTER AWARD OF CONTRACT, 1 sets of specifications and drawings will be furnished in PDF format and 1 in hardcopy.
- B. Additional sets of drawings may be made by the Contractor, at Contractor's expense.

**1.4 CONSTRUCTION SECURITY REQUIREMENTS**

- A. Security Plan:
  - 1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
  - 2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.
- B. Security Procedures:
  - 1. General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.

2. For working outside the “regular hours” as defined in the contract, The General Contractor shall give 3 days notice to the Contracting Officer so that escort 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 COR.
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.

## **1.5 CONSTRUCTION SAFETY**

### **A. Safety Submittals Required Prior To Commencing Work and/or Notice To Proceed:**

1. The contractor will designate a competent person (CP) to serve as the sole point of contact responsible for safety management on the project site. Competent persons are defined as those capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous, or dangerous, and who have the authority to take prompt corrective measures to eliminate them.
  - a. The contractor will submit proof of 30-hour OSHA safety course (i.e., copies of documentation) for prime contractor-designated competent persons as well as any subcontractor-designated competent persons that will work on the site. This proof is a formal, required submittal that requires approval by the contracting officer’s representative (COR).
3. The contractor will submit proof of 10-hour OSHA safety course (i.e., copies of documentation) for all other prime contractor employees as well as any subcontract employees that will work on the site. This proof is a formal, required submittal that requires approval by the contracting officer’s technical representative (COR).
4. Submittals must include the names, qualifications, and training dates for the prime contractor-designated competent person (CP) designated to administer the site-specific safety program, as well as the CP (if different) for high risk activities as required by OSHA regulations, such as scaffolding, crane operations, excavations, trenching, etc.
5. Federal acquisition regulation (FAR) 52.236-13, with alternate 1, requires submittal and approval of a safety plan, specific to the project and to the construction site. The contractor will submit a safety plan that includes detailed safety precautions and practices to mitigate identified hazards specific to this project and to this construction site. This plan is a formal, required submittal that requires approval by the contracting officer’s technical representative (COR).
  - a. See Appendix A for VA provided Safety Plan Template.

## **1.6 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):
    - E84-2008.....Surface Burning Characteristics of Building Materials
  2. National Fire Protection Association (NFPA):
    - 10-2006 .....Standard for Portable Fire Extinguishers
    - 30-2007 .....Flammable and Combustible Liquids Code
    - 51B-2003.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work
    - 70-2007 .....National Electrical Code
    - 241-2004 .....Standard for Safeguarding Construction, Alteration, and Demolition Operations
  3. Occupational Safety and Health Administration (OSHA):
    - 29 CFR 1926 .....Safety and Health Regulations for Construction
- 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 for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES Prior to any worker for the contractor or subcontractors beginning work, they 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. Documentation shall be provided to the Resident Engineer that individuals 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. 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.
  - F. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to COR.
  - G. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
  - H. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
  - I. 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/or 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 Resident Engineer.

- J. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with COR.
- K. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to COR.
- L. 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.
- M. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.
- N. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.
- O. 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.

#### **1.7 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 COR. 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. The Contractor shall, under regulations prescribed by the COR, use only established roadways. 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.
- C. Working space and space available for storing materials shall be as determined by the COR.
- D. Workmen are subject to rules of Medical Center applicable to their conduct.
- E. 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 COR where required by limited working space.
  - 1. Do not store materials and equipment in other than assigned areas.
  - 2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to the 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.

- F. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by the COR. All such actions shall be coordinated with the Utility Company involved:
  - 1. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- G. 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.
- H. 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.
- I. Coordinate the work for this contract with other construction operations as directed by the COR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

#### **1.8 INFECTION PREVENTION MEASURES**

- A. Implement the requirements of VAMC's Infection Control Risk Assessment (ICRA) team. ICRA 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 ICRA Group. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to the COR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
  - 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 RE 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 Resident Engineer. 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 may be used where dust control is the only hazard, and an agreement is reached with the COR and Medical Center.
    - b. HEPA filtration is required where the exhaust dust may reenter the breathing zone. 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 prefilter 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 Resident Engineer 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.

#### **1.9 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 noted on drawings or in specifications. 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 Resident Engineer.
  - 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.

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

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

### **1.11 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 Resident Engineer. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the Resident Engineer 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 indicated on drawings and 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).
- E. Upon completion of the work, the Contractor shall furnish the Resident Engineer, reproducible drawings at the scale of the contract drawings.

### **1.12 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 Resident Engineer's review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings to the Resident Engineer within 15 calendar days after each completed phase and after the acceptance of the project by the Resident Engineer.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

### **1.13 USE OF ROADWAYS**

- A. For hauling, use only established public roads and roads on the Medical Center property and, when authorized by the Resident Engineer, such temporary roads which are necessary in the performance of contract work.

### **1.14 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.



### **1.15 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. Coordinated by contractor with local power company MDU so they may protect their equipment if needed.
- 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. Coordinated by contractor with local power company MDU so they may protect their equipment if needed.
- 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.

### **1.16 INSTRUCTIONS**

- A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals (four copies each) for each separate piece of equipment shall be delivered to the Resident Engineer 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 instructions 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 Resident Engineer and shall be considered concluded only when the Resident Engineer is satisfied in regard to complete and thorough coverage. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the Resident Engineer, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

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**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 approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
  - A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
  - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
  - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
- 1-5. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by Resident Engineer 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 single units unless otherwise specified. 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 or FAX and shall contain the list of items, name of the 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. 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.
- D. Approved samples will be kept on file by the Resident Engineer 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.
- E. 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 approval to
- Catherine Craft  
Mail stop 138  
1898 Fort Road  
Sheridan, WY 82801

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SECTION 01 42 19  
REFERENCE STANDARDS

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

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

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

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

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

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

DEPARTMENT OF VETERANS AFFAIRS

Office of Construction & Facilities Management

Facilities Quality Service (00CFM1A)

811 Vermont Avenue, NW - Room 462

Washington, DC 20420

Telephone Numbers: (202) 461-8217 or (202) 461-8292

Between 9:00 AM - 3:00 PM

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

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

- AA Aluminum Association Inc.  
<http://www.aluminum.org>
- AABC Associated Air Balance Council  
<http://www.aabchq.com>
- AAMA American Architectural Manufacturer's Association  
<http://www.aamanet.org>
- AAN American Nursery and Landscape Association  
<http://www.anla.org>

AASHTO	American Association of State Highway and Transportation Officials <a href="http://www.aashto.org">http://www.aashto.org</a>
AATCC	American Association of Textile Chemists and Colorists <a href="http://www.aatcc.org">http://www.aatcc.org</a>
ACGIH	American Conference of Governmental Industrial Hygienists <a href="http://www.acgih.org">http://www.acgih.org</a>
ACI	American Concrete Institute <a href="http://www.aci-int.net">http://www.aci-int.net</a>
ACPA	American Concrete Pipe Association <a href="http://www.concrete-pipe.org">http://www.concrete-pipe.org</a>
ACPPA	American Concrete Pressure Pipe Association <a href="http://www.acppa.org">http://www.acppa.org</a>
ADC	Air Diffusion Council <a href="http://flexibleduct.org">http://flexibleduct.org</a>
AGA	American Gas Association <a href="http://www.aga.org">http://www.aga.org</a>
AGC	Associated General Contractors of America <a href="http://www.agc.org">http://www.agc.org</a>
AGMA	American Gear Manufacturers Association, Inc. <a href="http://www.agma.org">http://www.agma.org</a>
AHAM	Association of Home Appliance Manufacturers <a href="http://www.aham.org">http://www.aham.org</a>
AISC	American Institute of Steel Construction <a href="http://www.aisc.org">http://www.aisc.org</a>
AISI	American Iron and Steel Institute <a href="http://www.steel.org">http://www.steel.org</a>
AITC	American Institute of Timber Construction <a href="http://www.aitc-glulam.org">http://www.aitc-glulam.org</a>
AMCA	Air Movement and Control Association, Inc. <a href="http://www.amca.org">http://www.amca.org</a>
ANLA	American Nursery & Landscape Association <a href="http://www.anla.org">http://www.anla.org</a>
ANSI	American National Standards Institute, Inc. <a href="http://www.ansi.org">http://www.ansi.org</a>
APA	The Engineered Wood Association <a href="http://www.apawood.org">http://www.apawood.org</a>

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



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

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

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

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

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.etl.com>

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

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

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

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 <a href="http://www.natlhardwood.org">http://www.natlhardwood.org</a>
NIH	National Institute of Health <a href="http://www.nih.gov">http://www.nih.gov</a>
NIST	National Institute of Standards and Technology <a href="http://www.nist.gov">http://www.nist.gov</a>
NLMA	Northeastern Lumber Manufacturers Association, Inc. <a href="http://www.nelma.org">http://www.nelma.org</a>

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

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

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

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

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

RIS Redwood Inspection Service  
               See - CRA

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

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

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

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

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

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

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

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

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

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

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

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

UBC The Uniform Building Code  
See ICBO

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

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

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

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

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

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

**PART 1 – GENERAL**

**1.1 DESCRIPTION**

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

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.

**1.3 QUALITY ASSURANCE**

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible.  
Construction /Demolition waste includes products of the following:
  - 1. Excess or unusable construction materials.
  - 2. Packaging used for construction products.
  - 3. Poor planning and/or layout.

4. Construction error.
  5. Over ordering.
  6. Weather damage.
  7. Contamination.
  8. Mishandling.
  9. Breakage.
- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
  - C. Contractor shall develop and implement procedures to reuse and recycle new materials 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> 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 Resident Engineer a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
  - 1. Procedures to be used for debris management.
  - 2. Techniques to be used to minimize waste generation.
  - 3. Analysis of the estimated job site waste to be generated:
    - a. List of each material and quantity to be salvaged, reused, recycled.
    - b. List of each material and quantity proposed to be taken to a landfill.
  - 4. Detailed description of the Means/Methods to be used for material handling.
    - a. On site: Material separation, storage, protection where applicable.
    - b. Off site: Transportation means and destination. Include list of materials.
      - 1) Description of materials to be site-separated and self-hauled to designated facilities.
      - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
    - c. The names and locations of mixed debris reuse and recycling facilities or sites.
    - d. The names and locations of trash disposal landfill facilities or sites.
    - e. Documentation that the facilities or sites are approved to receive the materials.
- B. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- C. 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**

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.

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

## **1.7 RECORDS**

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

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

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



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

## **PART 3 - EXECUTION**

### **3.1 COLLECTION**

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

### **3.2 DISPOSAL**

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

### **3.3 REPORT**

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

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## **SECTION 02 41 00 DEMOLITION**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION:**

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

#### **1.2 RELATED WORK:**

- A. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- 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. 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,
- C. 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.
- G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items shall be repaired or replaced as approved by the Resident Engineer. The Contractor shall coordinate the work of this section with all other work as required.
- I. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7 INFECTION PREVENTION MEASURES.

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

### **PART 3 – EXECUTION**

#### **3.1 DEMOLITION:**

- A. Completely demolish and remove as noted below:
  - 1. As required for installation of new utility service lines.
- B. Debris shall become property of Contractor and shall be disposed of by him daily, off the Medical Center to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be

stored in areas specified by the Resident Engineer. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

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

**3.2 CLEAN-UP:**

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

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## **SECTION 26 05 11 REQUIREMENTS FOR ELECTRICAL INSTALLATIONS**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. This section applies to all sections of Division 26. All work shall be performed per the requirements of the 2011 NEC, and the latest versions of VA and NFPA codes and requirements. Division 0 and Division 1 project Specifications shall equally apply to the work and all requirements of those specifications, shall be adhered to. Should there be a conflict, the most stringent or costly requirement shall be applied.
- B. The plans and specifications shall work together to form one scope. The contractor shall provide work required or specified as required for a complete installation even though not every incidental item will be shown on the plans. Likewise, the contractor shall provide work shown on plan even if it is not fully specified to provide a complete installation. Should the contractor or vendor see an item during bidding that is extremely expensive; the contractor is encouraged to identify the item in writing and provide a recommended alternative during the bidding process.
- C. Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, cable, switchboards, switchgear, panelboards, motor control centers, and other items and arrangements for the specified items are shown on drawings.
- D. Electrical service entrance equipment (arrangements for temporary and permanent connections to the utility's system) shall conform to the utilities and primary system requirements. Coordinate fuses, circuit breakers and relays with the utility's system, and obtain utility approval for sizes and settings of these devices.
- E. Deviations from design plans may be submitted in writing to the A&E and VA. Only deviation request submitted with adequate information for thorough review and demonstrating that it provides a superior end product and/or reduced cost will be considered. The contractor's shall remain responsible the deviation's compliance with all project requirements including, but not limited to; performance, codes, damages, space requirements, related costs, schedule, warranty, etc.
- F. Wiring ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways accordingly sized. Aluminum conductors are prohibited.

#### **1.2 SUMMARY OF WORK**

- A. The project scope installs a standby emergency generator and emergency power systems (meeting UL2200, UL508, UL142, and UL498) to the existing Water Treatment Plant(WTP), near the Department of Veteran Affairs campus - Sheridan, WY.
- B. The generator unit will be installed on a new generator pad, which will be built to the north of the existing building plant.

- C. The changes to the WTP power distribution creates separate life safety and mission critical equipment emergency power branches.
- D. Each branch is a 277/408V, three-phase system.
- E. Loads are to be re-powered from the existing normal power panels and mixing of branch circuit wiring shall be eliminated.
- F. Multi-wire branch circuits associated with the work on the plans shall be divided, multi-pole breakers shall be installed, or handles ties between single-phase breakers shall be installed, as appropriate.
- G. Existing conduit/branch wiring shall be extended where required, matching existing wire and conduit. The contractor shall verify that all existing wiring meet the latest NEC requirements.
- H. The contractor is required to submit all local and state applications and permits for construction as applicable to this project including, but not limited to, general construction permits, transportation permits, and all Wyoming DEQ permit applications (Air Quality, Engine Installation/removal, etc) as applicable to this project. Some applications shall be submitted on behalf of the owner; VAMC, Sheridan Wyoming. The DEQ submittals forms and requirements can be found at <http://deq.state.wy.us/aqd/construction.asp> and shall be prepared in accordance with the VA and The State of WY requirements. Any and all DEQ forms required to be submitted by the VAMC to the State shall be prepared, to the extent possible, by the contractor for submittal by the VA to the State of Wyoming.

### **1.3 PHASING OF WORK**

- A. This project shall be performed in phases in order to maintain the operation of the facility. Refer to applicable project phasing/risers.
- B. This mission critical facility must remain operational at all times.
- C. In as much as possible, each system/circuit is to be kept operational at all times. Any work that affects existing electrical or building utility systems shall be coordinated with and approved by VA prior to commencing work. All existing electrical system interruptions shall be kept to an absolute minimum. If/when an outage will involve single or multiple panels; the contractor shall verify all/every load and explicitly delineate the affected loads to the staff during the weekly construction meeting. To minimize service interruptions, where scheduled for transfer to another panel, individual loads shall be transferred off of panel(s) requiring an outage, prior to the outage. Required outages shall be planned in advance and approved by the COTR. Refer to the riser drawings.
- D. Step 1 – The new Generator shall be installed with all conduits/duct banks for services from WTP to the Generator. Install the necessary risers including wiring, conduit, automatic and manual transfer switches, generator and transfer switch bases, panels, disconnects, UG concrete-encased ducts, and distribution panels to provide for the needs of the new generator. Install, commission, and test the new generator in its entirety including fuel and all fuel monitoring/controls.
- E. Step 2 – Install balance of risers, panels, etc to complete the life safety and equipment branches power distribution. Complete transfer of all loads. Transfer remaining loads, transfer re-designated panels and demo existing abandoned electrical equipment and turn over to the VAMC. Maintain all services to the

Generator that could jeopardize the new backup power to WTP. Test the function of each transfer switch as loads/service begin to rely on their proper operation. Re-test and demonstrate as required during final commissioning.

- F. Remove and turn over all abandoned equipment to VAMC, unless specifically noted otherwise. Remove equipment/materials from the site that is not desired to be salvaged by the VAMC.
- I. The generalized outline above provides recommendation to guide/supplement the Work Method of Procedure (MOP). All work must be proposed on an MOP and approved by the COTR prior to the work commencing. The contractor provided MOP shall detail every aspect, step by step, for completion of the work required on this project. If a MOP cannot be followed, the contractor shall immediately provide an updated MOP and gain approval by the COTR prior to commencing work. Review by the COTR does not relieve the contractor of the responsibility for a thoroughly thought out and detailed MOP that considers:
  - 1. Complying with all safety, NEC, NFPA, VA and other code requirements.
  - 2. Any legal liabilities for violating of all safety, NEC, NFPA, VA and other code requirements, damages occurred, cost overruns, etc, in the execution of an inaccurate or poorly planned MOP.
  - 3. Complying with all contract documents requiring, but not limited to, commissioning, completion dates, warranties, drawings/plans, specifications, materials, and/or required project quantities.

#### **1.4 MINIMUM REQUIREMENTS**

- A. References to the National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL) and National Fire Protection Association (NFPA) are minimum installation requirement standards.
- B. The construction, (including, but not limited to, pre-bid, pre-construction, etc.), commissioning, associated construction administration, etc., shall be in accordance with the contract documents (including, but not limited to, plans, specifications, selection criteria, performance requirements, etc.) and with the most recent version of all applicable codes (including, but not limited to, NFPA, NEC, JCAHO, OSHA, ASHRAE-90.1, WY DEQ, EPA, etc.), the Energy Independence and Security Act, WY State Historical Preservation Office (SHPO) and VA Publications, including, but not limited to, VA Construction Procedures (PG-18-3), VA Energy Reduction Manual, VA Construction Standards, VA Commissioning Manual, etc.
- C. All work shall conform to the minimum requirements of the Department of Veteran Affairs (VA).
- D. In the unlikely event of a conflict among the aforementioned requirements (code, manuals, etc.), in general, the more stringent or restrictive (more efficient, safer, etc.) requirement shall take precedence and the installation, etc. shall comply with that requirement. The contractor shall advise the A/E, Commissioning Agent (CxA) and COTR of any and all conflicts. Resolution options shall be developed in coordination with A/E and CxA and shall consider all technical aspects including, but not limited to, VA requirements/standards, efficiency, safety, cost, and potential impact to the facility operations. The contractor shall make a proposal with a minimum of three (3) recommended resolutions to rectify the conflict as outlined below.
  - 1. Recommended resolutions shall avoid contract constructive changes (financial adjustments) to the project.

2. Small daily problems, conflicts, coordination, etc., (daily/routine items without anticipated financial adjustments) shall, in the interest of project efficiency, be first resolved at the lowest level (CxA, A/E, Contractor, and if required, COTR).
  3. Larger problems, conflicts, deficiencies, etc. (issues in which financial adjustments are likely required) with design, construction, administration, commissioning, phasing, etc. shall be concisely defined and presented to the A/E, VA Contracting Officer (CO) and the VA COTR. The proposed resolution shall be coordinated with the Architect/Engineer (A/E) and the Commissioning Agent (CxA) and agreed upon prior to resolution presentation to the CO and COTR. All three recommended resolution options and the preferred resolution shall be presented to the COTR with all technical aspects (including but not limited to, VA requirements/standards, efficiency, safety, cost, and potential impact to the facility operations) to be considered and outlined.
  4. The CO and COTR shall provide final direction.
- E. In the unlikely event of problems, conflicts, deficiencies, etc., with design, construction, commissioning, etc., the Contractor shall notify Contracting Officer and COTR of the aforementioned problems, conflicts, deficiencies, etc., and the Contractor shall make provide a minimum of three (3) resolution recommendations. Resolution recommendations shall be coordinated with A/E and CxA. Resolution options shall consider all technical aspects including, but not limited to, VA requirements/standards, efficiency, safety, cost, and potential impact to the facility operations. In addition:
1. Recommended resolutions shall avoid contract constructive changes to project.
  2. Small daily problems, conflicts, coordination, etc., (daily/routine items without anticipated financial adjustments) shall, in the interest of project efficiency, be first resolved at the lowest level CxA, A/E, Contractor, and if required, COTR).
  3. Larger problems, conflicts, deficiencies, etc. (issues in which financial adjustments are likely required) with design, construction, administration, commissioning, phasing, etc. shall be concisely defined and presented to the A/E, VA Contracting Officer (CO) and the VA COTR. The proposed resolution shall be coordinated with the Architect/Engineer (A/E) and the Commissioning Agent (CxA) and agreed upon prior to resolution presentation to the CO and COTR. All three recommended resolution options and the preferred resolution shall be shall be presented to the COTR with all technical aspects (including but not limited to, VA requirements/standards, efficiency, safety, cost, and potential impact to the facility operations) considered and outlined.
  4. The CO and COTR shall provide final direction.
- F. All requirements and associated direction from the Contracting Officer and COTR shall be complied with.
- G. The final installation shall provide for a complete system with all incidental work provided.

## **1.5 TEST STANDARDS**

- A. All materials and equipment shall be listed, labeled or certified by a nationally recognized testing laboratory to meet Underwriters Laboratories, Inc., standards where test standards have been established. Equipment and materials which are not covered by UL Standards will be accepted provided equipment and material is

listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Equipment proposed for the project shall be the latest approved design of the equipment as manufactured by a nationally recognized manufacturer to be in conformity with the latest applicable standards, UL listings, NFPA requirements, and NEMA standards. This shall apply to all equipment, from devices to generators.

C. Definitions:

1. Listed; Equipment, materials, or services 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 equipment or materials or periodic evaluation of services, and whose listing states that the equipment, material, or services either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
2. Labeled; Equipment or materials 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 equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
3. Certified; equipment or product which:
  - a. Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
  - b. Production of equipment or product is periodically inspected by a nationally recognized testing laboratory.
  - c. Bears a label, tag, or other record of certification.
4. Nationally recognized testing laboratory; laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.

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

A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

B. Product Qualification:

1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.



- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within six hours of receipt of notification that service is needed. Submit name and address of service organizations.

## **1.7 APPLICABLE PUBLICATIONS**

- A. Applicable publications listed in all Sections of Division are the latest issue, unless otherwise noted.

## **1.8 MANUFACTURED PRODUCTS**

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.
- B. When more than one unit of the same class or type of equipment is required, such units shall be the product of a single manufacturer.
- C. Equipment Assemblies and Components:
  - 1. Components of an assembled unit need not be products of the same manufacturer.
  - 2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  - 3. Components shall be compatible with each other and with the total assembly for the intended service.
  - 4. Constituent parts which are similar shall be the product of a single manufacturer.
- D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.
- E. When Factory Testing Is Specified:
  - 1. The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the COTR a minimum of 15 working days prior to the manufacturers making the factory tests.
  - 2. Four copies of certified test reports containing all test data shall be furnished to the COTR prior to final inspection and not more than 90 days after completion of the tests.
  - 3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.
- F. Where a specific manufacturer/product is specified by plans or specifications, it shall carry the same meaning as "specified project or approved equal" and shall represent the general quality. Information for equivalent products from other manufacturers may be submitted as a product substitution for engineering approval not less than 20 days (minimum) prior to the bid date. Substitutions shall conform to the following:
  - 1. Submittal of an alternate product or system indicates that the contractor has verified and guarantees that the quantities, capacities, functionality, performance, and code/VA requirement compliance of the proposed substitutions are at least equivalent, to the specified product or systems.
  - 2. The engineer and VA reserve the right to deny acceptability of a proposed product or systems for any reason and shall notify all bidders of the equal product by addendum.
  - 3. Any proposed substitution shall consider and maintain required code and working clearances.
  - 4. Any proposed substitution for material, product, or systems shall include adequate drawings and engineering analysis to accurately delineate the proposed change, including, but not limited to load

calculations, space and working clearances analysis, etc. Submittals shall clearly indicate any construction, material and/or performance differences between that specified and that being proposed.

1. Submittals with incomplete information shall not be considered.
2. Submittals demonstrating inferior product or quantities shall not be considered.
5. Should the substituted product consequently require increased space, revised systems, modification, revisions to the structure, finish, ducting, piping, electrical or relocation of other equipment or systems, consequential project design revisions, revised engineering design and design reviews, the contractor shall bare the sole responsibility of the required changes and any direct or indirect cost associated with the revision(s), including re-design cost.
6. See plans and Sections 1.2 and 1.15 for additional information.

### **1.9 EQUIPMENT REQUIREMENTS**

- A. Where variations from the contract requirements are requested in accordance with the GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

### **1.10 EQUIPMENT PROTECTION**

- A. Equipment and materials shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
  1. Store equipment indoors in clean dry space with uniform temperature to prevent condensation. Equipment shall include but not be limited to switchgear, switchboards, panelboards, transformers, motor control centers, motor controllers, uninterruptible power systems, enclosures, controllers, circuit protective devices, cables, wire, light fixtures, electronic equipment, and accessories.
  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, as determined by the COTR, placed in first class operating condition or be returned to the source of supply for repair or replacement.
  4. Painted surfaces shall be protected with factory installed removable heavy craft paper, sheet vinyl or equal.
  5. 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.

### **1.11 PERMITS**

- A. The contractor shall secure all permits in connection with work.

### **1.12 WORK PERFORMANCE**

- A. All electrical work must comply with the requirements of the VA, NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J, OSHA Part 1910 subpart S and OSHA Part 1910 subpart K in addition to other references required by contract.

- B. Work shall be performed by a licensed and bonded contractor utilizing tradesmen skilled in the art and in accordance with acceptable practices.
- C. Job site safety and worker safety is the responsibility of the contractor.
  - 1. Due to potentially mentally impaired building occupants, the contractor shall, at all times, keep tools in personal possession or locked for safekeeping and to protect the building occupants from access to any tools or potentially dangerous materials.
- D. The Contractor is responsible for coordinating, providing and installing all electrical systems in conformance with the contract documents (drawings, specifications, etc.), NEC, NFPA, ANSI/ASME and all VA applicable codes and ordinances. Where contract documents are more stringent than code, the contract documents shall take precedence and shall be followed. In addition, direction from AHJ shall be complied with. See drawings and Section 1.4 herein for additional requirements. The contractor shall provide and install all lighting, power, special systems (fire alarm, telephone/communication, data, etc.), associated distribution and all incidental items required for complete system of work whether or not specifically mentioned or indicated in specifications or on drawings. Changes in the location of conduits, outlets, fixtures, switches, panels, equipment, etc., if necessary due to obstacles or work of other trades, shall be made by contractor at no extra cost. All deviations from drawings and specifications requested by contractor, due to unknown site factors or any other, shall be submitted in writing to A&E and VA. VA and A&E retain right to deny deviation approval. Deviation request shall meet aforementioned requirements and codes, make for an equal or better job. Authorization or non authorization of deviation request does not relieve contractor of responsibility for:
  - 1) Complying with all safety, security and all code requirements.
  - 2) Any legal liabilities for violation of aforementioned, damages occurred, cost overruns, etc., in the execution of deviation.
  - 3) Complying with contract document requirements including, but not limited to completion dates, warranties, drawings, specifications acceptable material use and associated number and locations, etc.
- E. The 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. Electricians must wear personal protective equipment while working on energized systems in accordance with NFPA 70E.
  - 3. Before initiating any work, a job specific work plan must be developed by the contractor with a peer review conducted and documented by the COTR and Medical Center staff. The work plan must include

procedures to be used on and near the live electrical equipment, barriers to be installed, and safety equipment to be used and exit pathways.

4. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the COTR.
- F. Prior to the start of drilling or excavation work, the contractor shall have coordinated and checked the anticipated work with the VA, local municipality and /or utility companies and have obtained the necessary utility locates in the vicinity of work. The contractor shall perform all work in a manner that no holes are left open or unprotected at the end of each day(s) operation.
- G. For work on existing stations, arrange, phase and perform work to assure electrical service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.
- H. 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.
- I. Coordinate location of equipment and conduit with other trades to minimize interferences.

### **1.13 EQUIPMENT INSTALLATION AND REQUIREMENTS**

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Working spaces shall not be less than specified in the NEC for all voltages specified.
- C. Inaccessible Equipment:
  1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
  2. "Conveniently accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.
- D. **ALL EQUIPMENT SHALL BE INSTALLED IN THE LOCATIONS AND OF QUANTITY PER THE DRAWINGS AND QUALITY PER THE EQUIPMENT SPECIFICATION SECTION, THE NEC, THE MANUFACTURER'S RECOMMENDATIONS, AND AS MAY BE REQUIRED BY THE SELECTED EQUIPMENT, CODES, STANDARDS OR REGULATIONS, EVEN IF NOT SHOWN ON THE PLANS.**

### **1.14 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, panelboards, cabinets, motor controllers (starters), safety switches, transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.

- B. Nameplates for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Nameplates for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 1/4 inch [12mm] high. Nameplates 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. See also Section 26 05 53, IDENTIFICATION AND LABELING.
- C. Install adhesive arc flash warning labels on all new panels/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.

### **1.15 SUBMITTALS**

- A. within 30 days after contract awarded, electrical contractor shall submit in brochure form, the shop drawings on electrical equipment used on this project. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submittals (shop drawings and brochure of equipment) shall be marked with arrow to show exact features provided. Submit to A&E and VA, for review, certified print manufacturer's literature on electrical materials used on the project. Submittal shall include, but is not limited to generator, automatic transfer switches, switchboards, panels, breakers, wiring devices (switches, outlets, etc.), lighting fixtures, disconnects, motor starters, FA equipment, etc. the contractor shall sign all copies attesting to the correctness and compliance of the submittal. Tab dividers shall be used to separate the literature for equipment. Submittals marked "revise and resubmit" shall be changed and resubmitted for review. See contract document (specifications, etc.) for additional requirements.
- B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.
- C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
- 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, 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 those replacement parts recommended by the equipment manufacturer.
- F. Substitutions
1. Materials/Equipment are listed and specified as representative of general quality. Information for equivalent products from other manufacturers may be submitted prior to the bid for A&E review with the following conditions:
    - a. The determination by the Engineer and VA will be final.
    - b. Submittals of incomplete information will not be reviewed.
    - c. Submittals utilizing non-applicable information will not be reviewed.
    - d. Submittal of a product indicates that the contractor has verified and confirmed that the quality, capacities, functionality, performance, of the proposed items is not less than that of a specified item-it must not be to be considered. In addition, space restrictions must be acceptable.
    - e. If the installation of a substituted product requires increased space, revised systems, relocation of other systems, the cost of the changes required (as determined by design) including design review and changes, shall be the responsibility of the contractor.
    - f. See also requirements in Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
    - g. Substitutions are subject possible rejection if not in complete conformance with the contract documents when submitted.
    - h. See drawings and Section 1.4 herein for additional requirements.
- G. Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
1. Maintenance and Operation Manuals: Submit for all systems and equipment specified in Division 26 and as required for specific systems and equipment may be as further specified in the technical sections. Furnish four copies, bound in 3-ring binder catalog containing certified print submittal material. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
  2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each

subcontractor installing the system or equipment and the local representatives for the system or equipment.

3. 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 and replacement frequencies.
  - h. Performance data.
  - i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
  - j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.
- H. Approvals will be based on complete submission of manuals together with shop drawings.
- I. After approval and prior to installation, furnish the COTR with one sample of each of the following:
  1. A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
  2. Each type of conduit coupling, bushing and termination fitting.
  3. Conduit hangers, clamps and supports.
  4. Duct sealing compound.
  5. Each type of receptacle, toggle switch, occupancy 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.
- J. The contractor shall submit 'Work Method of Procedures' in pdf form of work authorizations and methods of procedures (MOP).

#### **1.16 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.

### **1.17 ACCEPTANCE CHECKS AND TESTS**

- A. The contractor shall furnish the instruments, materials and labor for field tests.
- B. The VAMC is contracting a third party commissioning agent. See Section 26 08 00, COMMISSIONING OF ELECTRICAL.

### **1.18 TRAINING**

- A. Training shall be provided in accordance with Article 1.25, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS and as may be required by the Commissioning Agent (CxA).
- B. Training shall be provided for the particular equipment or system as required in each associated specification. Contractor shall instruct VA (per VA's requested level) as to function, operation, maintenance, adjustment of equipment and systems installed. See contract document (specifications, etc.) for additional requirements.
- C. A training schedule and topic summary shall be developed and submitted by the contractor and approved by the COTR at least 30 days prior to the planned training.
- D. Training shall be based on and provided in concert with the approved shop drawings and Operation & Maintenance manuals.
- E. The trainer(s) shall instruct VA personnel such that the facility operation and maintenance personnel are facility as to function, operation, maintenance, seasonal requirements, testing, and adjustment of equipment.

### **1.19 PROJECT CONDITIONS**

- A. The electrical contractor should visit the site during the prebid conference to gain an understanding of the many site/building conditions.
- B. All work shall be within the base bid.
- C. Proposed equipment shall not encroach on working, service or code-required clearances. The contractor shall verify all clearances prior to ordering of any equipment.
- D. The project is a sizable remodel project within a 24/7 operating facility. As such, the contractor shall be responsible to fully understand the following:
  - 1. The electrical contractor shall provide schedules and planning according to the general conditions, to include the following:
    - a. The contractor shall prepare a full project schedule.
    - b. The electrical contractor shall participate in weekly project coordination meetings with the VAMC.
    - c. The electrical contractor shall prepare 2-week look-ahead schedule each week while performing work that may impact operations including, but not limited to:
      - i. Water treatment plant.
      - ii. Work installing risers and/or conduit.
      - iii. Work generating any noise, dust, or potential infection in the main facility.
    - d. The contractor shall endeavor to maintain operations of the Pharmacy/Cache, SPD, Kitchen, Dining, and EOC.



- e. The contractor shall delineate any/all potential disturbances to operations during the coordination meeting.
  - f. The contractor shall present/review infection and/or noise control to operations during the coordination meeting.
  - g. The contractor shall submit the MOP a minimum of 2 days prior to the coordination meeting.
2. No work shall be performed while equipment is energized without verifying compliance with NFPA 70E and obtaining written permission from the VA Representative.
  3. The contractor shall submit and gain approval of an acceptable lock-out tag-out procedure prior to commencing any work.
  4. Access to some rooms may be limited.
  5. The contractor work shall always yield to building occupants.
  6. The work is drawn from site observation and existing plans. The contractor shall be responsible to field verify all existing conditions that may affect his bid and make any necessary associated allowances. Required construction deviations from the plans and specifications shall be brought to the attention of the Architect/Engineer prior to bid. All discovered conditions during bidding or installation shall be recorded on the field record plans.
  7. The facility must remain fully operational to the extent possible. Any service interruptions must be kept to an absolute minimum. Recommended project phasing has been depicted by the plans and specifications to minimize the service interruptions. Adjustments to the recommended phasing are allowed (and may be required) providing the adjustment results directly in reduction of service interruptions or is necessary to maintain codes and/or compliance with other requirements. NOTE: The contractor shall provide a MOP for any normal and emergency power system interruption.
  8. All life-safety systems available during the evenings. These systems may NOT be left in any type of derangement over the evening that would prevent normal operation and/or protection of occupants.
  9. The contractor shall provide for noise, dust, infection control, and vibration containment as required maintaining facility normal business operations in a healthcare environment. Work which must generate noise shall be performed during the hours of the day by a process resulting in least disruption to the VAMC operations and must utilize processes generating the least amount of noise. Prior to drilling or cutting, the contractor shall obtain proper permits and approvals per the VA requirements.
  10. Any/all work which may affect the normal operation of building systems shall be identified to the VAMC not less than two weeks in advance of the work and must be approved by the VAMC prior to commencement of that work. This includes any disruption to traffic systems including parking, drives, docks, etc.
  11. The contractor shall provide surface repair, and/or stainless steel cover plates in finished spaces where devices/equipment are indicated for removal without new devices/equipment being indicated at that same location.

12. If any existing condition, equipment or systems are concealed and is only discovered during the work and will require demolition, relocation, or reconnection this work shall be brought to the attention of the COTR immediately. Damage to any existing system shall remain the responsibility of the contractor.
13. The electrical contractor shall maintain the operation of the existing Fire Alarm and all other life-safety systems at all times.
14. Penetrations of fire/smoke rated assemblies shall be repaired to match the existing rating. All corridor walls shall be assumed fire resistive rated a minimum of one hour. Seal work shall be considered incidental to the work. All fire/smoke seals shall be per Section 07 84 00 FIRESTOPPING.
15. The contractor shall comply with all applicable VA regulations, policies and procedures, regarding fire, safety, lockdown, sanitation, environmental protection, security, courtesies, off- limits areas, possession of firearms, designated area visit escort rules, etc. while working or visiting the VA facility. See also Section 10 00 00 GENERAL CONDITIONS for additional working environment requirements.

E. Project Schedule Items:

1. The construction of the facility is urgent. See the general and VA conditions.
2. See project general conditions for more schedule information.

F. Limited Project Site/site use:

1. Parking around the project site is extremely limited. See project general conditions for information regarding material storage and staging.
2. No general construction trailer will be allowed on site. All logistics will be located and managed off site.
3. Existing facilities available for contractor use is further defined in the general conditions.
4. The contractor shall coordinate all logistic and shall not burden the VAMC to receive or store any materials.
5. The facility elevator may be used for contractor use providing:
  - a. The contractor and his operations yield to Patients.
  - b. The contractor and his operations yield to VAMC operations.
  - c. The contractor provides full-coverage interior surface protection in the form of plywood and/or elevator pads.

G. Federal Holidays, Operations and Planning

1. The contractor shall coordinate all scheduling, CPM, and construction phasing plans, MOPs, etc., with and to accommodate the following operational conditions: Medical Center operation hours are 7:30 am to 4:00 pm(MDT) daily Monday through Friday, excluding federal holidays. Access to the Medical Center during other times must be requested in writing a minimum of three (3) weeks prior to the requested date and time period. Project schedules, shall take into account the limited access during these periods and Federal Holidays. Typically, permission to work outside standard business hours shall only be granted when work during standard business hours directly conflicts with VAMC Sheridan facility Operations. The Contractor shall not count on working on, and may only work on

Federal holidays, weekends, and outside operation hours when specifically approved by the Contracting Officer (CO).

## **1.20 ELECTRICAL DEMOLITION**

- A. The project shall require limited general materials demolition. However, considerable conduit and wire is required to be demolished and shall be performed per the following:
  - 1. No work shall be performed while equipment is energized without written permission from the VA Representative and verified compliance with NFPA 70E. See WORK PERFORMANCE process herein.
  - 2. Demolition work resulting in wall, floor or ceiling voids or damage shall be patched to match adjacent materials and surfaces.
  - 3. All materials indicated or inferred for demolition shall be removed in its entirety. No raceway or wiring shall remain if it is not used for another purpose. Concealed conduit in walls which is difficult to be removed, may remain. However, concealed conduit which may not be removed shall be capped.
  - 4. The VAMC shall retain the right to any/all removed material. However, should the VAMC not desire to retain removed material, the contractor shall remove from site and properly dispose of.
  - 5. Following current DEQ, Clean Water Act, Clean Air Act, Toxic Substances Control Act, OSHA and/or VA regulations, the contractor shall be responsible to identify, collect, package and store all material, but not limited to electrical-related hazardous materials (I.E fluorescent lamps, HID lamps, and ballast containing PCB's). The contractor shall provide employees appropriate training, certifications, and shall provide for proper disposal of all materials, including hazardous materials and provide documentation of proper disposal to the VAMC. The contractor shall weigh all disposed material and provide updates at the weekly meetings and/or by separate report.
  - 6. Unless the system is scheduled for demolition, the contractor shall be responsible to understand and maintain the circuits, feeders, controls, etc for any systems/equipment within the area in which they are working. Damage (not scheduled for demolition) as a result of the contractors work shall be repaired by the contractor at no additional cost to the VAMC. Materials shall provide equal wall or ceiling ratings. Aesthetic appearance shall be approved by the VAMC and architect.

## **1.21 ELECTRICAL SITEWORK**

- A. The Underground work may only be performed after all underground utilities in the vicinity of the work has been located and a 'locates report' has been provided to the VA.
- B. Prior to the start of drilling or excavation work, the contractor shall have coordinated and checked the anticipated work with the VA, local municipality and/or utility companies and have obtained the necessary utility 'locates' in the vicinity of work.
- C. No underground work may be performed until the method and route has been approved by the engineer and VA. The installation shall be planned to minimize damage to existing finished surfaces, and to existing or planned vegetation. Final location of site j-boxes, fixtures, transformer pad, etc., shall be set as approved by the VA. Trenching shall only take place with the prior approval of the VA.

- D. All work shall be performed under traffic conditions. Provide continuous access to all adjacent VA and business establishments at the existing driveways and approaches at all times.
- E. Locations, sizes and quantities of junction boxes are approximate and shall be verified for the required installation. The contractor shall field verify condition, adjust junction box sizes and quantities and bid accordingly. Final locations of junction boxes, equipment, etc shall be coordinated with the VA and approved by the VA prior to the start of the work.
- F. Unless indicated as such on plans, approved by the VA and utility, direct bury underground conduit may not be installed over piping or other systems unless allow by VA and utility. If installed over/under other site systems, a minimum of 12" clearance shall be maintained. Conduits shall be concrete encased where conduit is subject to damage or required by code.
- G. Continuous traffic access shall be maintained on all drives and approaches.
- H. Underground work may not be performed without protective measures when the weather is unfavorable for proper restoration. The architect and/or VAMC shall be consulted for that determination.
- I. Exterior surfaces shall be left in a safe condition. The contractor shall perform all work in a manner that no holes are left open or unprotected at the end of each days(s) operation.
- J. Contractor shall avoid damaging all existing landscape vegetation, etc.

#### **1.22 ELECTRICAL WARRANTY**

- A. The contractor guarantees that all work will be free from defects of materials and workmanship for a period of at least one (1) year from the date of final acceptance. The warranty shall include labor, materials, and all other cost associate with the defective work. Contractor further agrees that he will replace or repair, to A&E and VA satisfaction all defective or damaged equipment and installation that becomes defective or damaged during the term of the warranty. Any replaced work will again be subject to a one (1) year warranty from the date of its installation.

- - - E N D - - -

**SECTION 26 05 21****LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW)****PART 1 - GENERAL****1.1 DESCRIPTION**

This section specifies the furnishing, installation, and connection of the low voltage power and lighting wiring.

**1.2 RELATED WORK**

- A. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-rated construction.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.
- E. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Installation of low-voltage conductors and cables in manholes and ducts.

**1.3 QUALITY ASSURANCE**

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

**1.4 FACTORY TESTS**

- B. Low voltage cables shall be thoroughly tested at the factory per NEMA WC-70 to ensure that there are no electrical defects. Factory tests shall be certified.

**1.5 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, furnish the following:
  - 1. Manufacturer's Literature and Data: Showing each cable type and rating.
  - 2. Certifications: Three (3) weeks prior to the final inspection, submit four copies of the following certifications to the COTR:
    - a. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
    - b. Certification by the contractor that the materials have been properly installed, connected, 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 the basic designation only.
- B. American Society of Testing Material (ASTM):
  - D2301-04.....Standard Specification for Vinyl Chloride Plastic Pressure -Sensitive Electrical Insulating Tape
- C. Federal Specifications (Fed. Spec.):
  - A-A-59544-00 .....Cable and Wire, Electrical (Power, Fixed Installation)
- C. National Fire Protection Association (NFPA):
  - 70-08 .....National Electrical Code (NEC)
- D. National Electrical Manufacturers Association (NEMA):
  - WC 70-09 .....Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy
- E. Underwriters Laboratories, Inc. (UL):
  - 44-05 .....Thermoset-Insulated Wires and Cables
  - 83-08 .....Thermoplastic-Insulated Wires and Cables
  - 467-071 .....Electrical Grounding and Bonding Equipment
  - 486A-486B-03.....Wire Connectors and Soldering Lugs for Use with Copper Conductors
  - 486C-04.....Splicing Wire Connectors
  - 486D-05.....Sealed Wire Connector Systems for Underground Use or in Damp or Wet Locations
  - 493-07 .....Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable
  - 514B-04.....Conduit, Tubing, and Cable Fittings
  - 1479-03 .....Fire Tests of Through-Penetration Fire Stops

## PART 2 - PRODUCTS

### 2.1 CONDUCTORS AND CABLES

- A. Conductors and cables shall be in accordance with NEMA WC-70 and as specified herein.
- B. Single Conductor:
  - 1. Shall be annealed copper.
  - 2. Shall be stranded for sizes No. 8 AWG and larger, solid for sizes No. 10 AWG and smaller.
  - 3. Shall be minimum size No. 12 AWG, except where smaller sizes are allowed herein.
- C. Insulation:
  - 1. XHHW-2 or THHN-THWN shall be in accordance with NEMA WC-70, UL 44, and UL 83.
  - 2. Direct burial: UF or USE shall be in accordance with UL 493.
- D. Color Code:
  - 1. Secondary service feeder and branch circuit conductors shall be color -coded as follows:

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

- a. Lighting circuit “switch legs” and 3-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 COTR.
2. Use solid color insulation or solid color coating for No. 12 AWG and No. 10 AWG branch circuit phase, neutral, and ground conductors.
3. Conductors No. 8 AWG and larger shall be 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 above.
  - c. Color as specified using 0.75 in [19 mm] wide tape. Apply tape in half -overlapping turns for a minimum of 3 in [75 mm] for terminal points, and in junction boxes, pull boxes, troughs, and handholes. 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.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.

## 2.2 SPLICES AND JOINTS

- A. In accordance with UL 486A, C, D, E, and NEC.
- B. Aboveground Circuits (No. 10 AWG and smaller):
  1. Connectors: Solderless, screw on, reusable pressure cable type, rated 600 V, 220° F [105° C], with integral insulation, approved for copper conductors.
  2. The integral insulator shall have a skirt to completely cover the stripped wires.
  3. The number, size, and combination of conductors, as listed on the manufacturer's packaging, shall be strictly followed.
- C. Aboveground Circuits (No. 8 AWG and larger):
  1. Connectors shall be indent, hex screw, or bolt clamp type of high conductivity and corrosion resistant material, listed for use with copper conductors.

2. Field -installed compression connectors for cable sizes 250 kcmil and larger shall have not fewer than two clamping elements or compression indents per wire.
  3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
  4. Plastic electrical insulating tape: Per ASTM D2304, flame -retardant, cold and weather resistant.
- D. Underground Branch Circuits and Feeders:
1. Submersible connectors in accordance with UL 486D, rated 600 V, 190° F [90° C], with integral insulation.

## **2.3 CONTROL WIRING**

- A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified for power and lighting wiring, except that the minimum size shall be not less than No. 14 AWG.
- B. Control wiring shall be large enough such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.
- C. All control cables/wiring routed outdoors and/or between structures underground shall be terminated on each end with surge suppression modules.
- D. All control cables/wiring routed underground shall be UL listed for wet labeled applications.

## **2.4 WIRE LUBRICATING COMPOUND**

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

## **2.5 FIREPROOFING TAPE**

- A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.
- B. The tape shall be self-extinguishing and shall not support combustion. It shall be arc-proof and fireproof.
- C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.
- D. The finished application shall withstand a 200-ampere arc for not less than 30 seconds.
- E. Securing tape: Glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19 mm (3/4 inch) wide.

## **2.6 WARNING TAPE**

- A. The tape shall be standard, 76 mm (3 inch) wide, 4-Mil polyethylene detectable type.
- B. The tape shall be red with black letters indicating "CAUTION BURIED ELECTRIC LINE BELOW".

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Install in accordance with the NEC, and as specified.
- B. Install all wiring in raceway systems except where direct burial or HCF Type AC cables are used.
- C. Splice cables and wires only in outlet boxes, junction boxes, pull -boxes, manholes, or hand holes.



- D. Wires of different systems (e.g., 120 V, 277 V, 480V) shall not be installed in the same conduit or junction box system.
- 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. For panel boards, cabinets, wireways, switches, and equipment assemblies, neatly form, train, and tie the cables in individual circuits.
- G. Seal cable and wire entering a building from underground between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.
- H. Wire Pulling:
  - 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables. Use lubricants approved for the cable.
  - 2. Use nonmetallic ropes for pulling feeders.
  - 3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the COTR.
  - 4. All cables in a single conduit shall be pulled simultaneously.
  - 5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- I. No more than three single-phase branch circuits shall be installed in any one conduit.
- J. The wires shall be de-rated in accordance with NEC Article 310. Neutral wires shall be considered current-carrying conductors and be sized accordingly.
- K. Voltage drop shall be limited to 3% on any new branch circuits. The plans call out that #12 AWG is the smallest conductor. However, voltage drop on 20 amp circuits will require:**
  - 1. #10 AWG for any branch circuit exceeding 70 lineal feet in length.**
  - 2. #8 AWG for any branch circuit exceeding 90 Lineal feet in length.**
  - 3. #6 AWG for any branch circuit exceeding 145 Lineal ft in length.**
  - 4. At new receptacles or switches, wire nut a #12 "termination pigtail" onto the upsized supply conductor for final termination to the device. This avoids unnecessary strain on the device. Up size the boxes if required due to splice per NEC Article 312.**
  - 5. Similar voltage drop conductor adjustments must be made by the contractor to any new branch circuits over 20 amps. The load shall be assumed at 80% of the overload protection rating.**

### 3.2 SPLICE INSTALLATION

- A. Splices and terminations shall be mechanically and electrically secure.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque values.
- C. Where the Government determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Government.

### 3.3 FEEDER IDENTIFICATION

- A. In each pull-box and junction box, install tags on all circuit cables and wires to clearly designate their circuit identification and voltage. The tags shall be the embossed brass type, 1.5 in [40 mm] in diameter and 40 mils thick. Attach tags with plastic ties.
- B. In each handhole, provide tags of the embossed brass type, showing the circuit identification and voltage. The tags shall be the embossed brass type, 1.5 in [40 mm] in diameter and 40 mils thick. Attach tags with plastic ties.

### 3.4 EXISTING WIRING

Unless specifically indicated on the plans, existing wiring shall not be reused for a new installation.

### 3.5 CONTROL AND SIGNAL WIRING INSTALLATION

- A. Unless otherwise specified in other sections install wiring and connect to equipment/devices to perform the required functions as shown and specified.
- B. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.
- C. Where separate power supply circuits are not shown, connect the systems to the nearest panel boards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.
- D. Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.
- E. System voltages shall be 120 volts or lower where shown on the drawings or as required by the NEC.

### 3.6 CONTROL AND SIGNAL SYSTEM 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.

### 3.7 Acceptance Checks and Tests

- A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices, such as fixtures, motors, or appliances. Test each conductor with respect to adjacent conductors and to ground. Existing conductors to be reused shall also be tested.
- B. Tests shall be performed by megger and conductors shall test free from short-circuits and grounds. Applied voltage shall be 500VDC for 300-volt rated cable, and 1,000VDC for 600-volt 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-volt rated cable and 100 megohms for 600-volt rated cable.
- C. Perform phase rotation test on all three-phase circuits.

- D. The Contractor shall furnish the instruments, materials, and labor for all tests.
- E. The contractor shall provide megger test reports to the VA for all feeders and branch conductors 100 amps or over. See commissioning requirements. Any circuit failing any test shall be replaced by the contractor at no additional cost to the Government.

### **3.8 EXISTING WIRING/CIRCUIT EXTENSIONS**

- A. Only wiring that conforms to the specifications and applicable codes may be reused. If existing wiring does not meet these requirements, existing wiring may not be reused and new wires shall be installed. Utilization of existing conduit has similar restrictions, see Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Existing wiring/conduit not specifically indicated or inferred for re-use shall be removed.
- B. Existing wiring required to be removed shall not be reused for any new installation.
- C. If the existing wiring conforms to these specifications, branch circuits being transferred / extended to new panels may be spliced at a practical/accessible (preferably above a ceiling) location for extension to the new panel/source. If possible, the contractor shall install the circuit extension from the splice location to the new source/panel prior to any service interruption to the circuit/equipment, thus limiting the any service interruption to the time required to make up the conduit connections and wiring splices at the splice location.
- D. New wiring/conduit extending an existing circuit shall not be smaller than that required by the NEC and shall not be smaller than the existing circuit construction methods.

--- E N D ---

**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the general grounding and bonding requirements for electrical equipment and operations to provide a low impedance path for possible ground fault currents.
- B. "Grounding electrode system" refers to all electrodes required by the latest version of the NEC, as well as made, supplementary, and lightning protection system grounding electrodes.
- C. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.
- D. The system shall have continuity of ground throughout the system. Raceway alone shall not be relied to the sole means of equipment grounding. All raceway shall have a continuous ground throughout, sized per the NEC.

**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 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring. Inclusive of requirements for low-voltage controls.
- H. Section 26 24 11, DISTRIBUTION SWITCHBOARDS: Low voltage distribution switchboards.
- I. Section 26 24 16, PANELBOARDS: Low voltage panelboards.
- L. Section 26 32 13, ENGINE-GENERATORS: Engine-generators.
- M. Section 26 36 23, AUTOMATIC TRANSFER SWITCHES: Automatic transfer switches.

**1.3 QUALITY ASSURANCE**

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

**1.4 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, furnish the following shop drawing, Test reports, and Certifications:
- B. Shop Drawings:
  - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
  - 2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
- C. Test Reports: Provide certified test reports of ground resistance.
- D. Certifications: Three (3) weeks prior to final inspection, submit four copies of the following to the COTR:
  - 1. Certification that the materials and installation is in accordance with the drawings and specifications.

2. Certification by the Contractor that the complete installation has been properly installed and tested.

## 1.5 APPLICABLE PUBLICATIONS

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.

- A. American Society for Testing and Materials (ASTM):
  - B1-07.....Standard Specification for Hard-Drawn Copper Wire
  - B3-07.....Standard Specification for Soft or Annealed Copper Wire
  - B8-04.....Standard Specification for Concentric-Lay-Stranded Copper  
Conductors, Hard, Medium-Hard, or Soft
- B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - 81-1983 .....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and  
Earth Surface Potentials of a Ground System
  - C2-07.....National Electrical Safety Code
- C. National Fire Protection Association (NFPA):
  - 70-08 .....National Electrical Code (NEC)
  - 99-2005 .....Health Care Facilities
- D. Underwriters Laboratories, Inc. (UL):
  - 44-05 .....Thermoset-Insulated Wires and Cables
  - 83-08 .....Thermoplastic-Insulated Wires and Cables
  - 467-07 .....Grounding and Bonding Equipment
  - 486A-486B-03 .....Wire Connectors

## PART 2 - PRODUCTS

### 2.1 GROUNDING AND BONDING CONDUCTORS

- A. An equipment grounding conductor shall be provided for all new equipment connections and shall be extended for all equipment circuit extensions. Equipment grounding conductors shall be UL 44 or UL 83 insulated stranded copper, except that sizes No. 10 AWG [6 mm<sup>2</sup>] and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG [25 mm<sup>2</sup>] and larger shall be identified per NEC.
- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes No. 10 AWG [6 mm<sup>2</sup>] and smaller shall be ASTM B1 solid bare copper wire.
- C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

### 2.2 GROUND RODS

- A. Steel or copper clad steel, 0.75 in [19 mm] diameter by 10 ft [30 M] long, conforming to UL 467.
- B. Quantity of rods shall be as required to obtain the specified ground resistance, and as shown on the drawings.

## 2.3 CONCRETE ENCASED ELECTRODE

Concrete encased electrode shall be minimum No. 4 AWG bare copper wire, installed per NEC.

## 2.4 GROUND CONNECTIONS

- A. Below Grade: Exothermic-welded type connectors.
- B. Above Grade:
  - 1. Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lockwashers.
  - 2. Connection to Building Steel: Exothermic-welded type connectors.
  - 3. Ground Busbars: Two-hole compression type lugs, using tin-plated copper or copper alloy bolts and nuts.
  - 4. Rack and Cabinet Ground Bars: one-hole compression-type lugs, using zinc-plated or copper alloy fasteners.

## 2.5 EQUIPMENT RACK AND CABINET GROUND BARS

Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 0.375 in [4 mm] thick x 0.75 in [19 mm] wide.

## 2.6 GROUND TERMINAL BLOCKS

At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

## 2.7 GROUNDING BUS

Where called out on plans, provide a pre-drilled rectangular copper bar with stand-off insulators, minimum 0.25 in [6.3 mm] thick x 4 in [100 mm] high in cross-section, length as shown on drawings, with 0.281 in [7.1 mm] holes spaced 1.125 in [28 mm] apart.

## 8. LOW VOLTAGE CABLING SURGE SUPPRESSION

Where plans call out for low-voltage controls cables to be routed underground, terminate each end of the control cables on UL listed surge suppression terminal block near the entry to the building.

# PART 3 - EXECUTION

## 3.1 GENERAL

- A. Ground in accordance with the NEC, as shown on drawings, and as specified herein.
- B. System Grounding:
  - 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
  - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
- C. Equipment Grounding: Metallic structures, including ductwork and building steel, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

- D. Special Grounding: Where applicable, 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 (except connections for which access for periodic testing is required), by exothermic weld.

### **3.3 SECONDARY EQUIPMENT AND CIRCUITS**

- A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.
- B. Metallic Piping, Building Steel, and Supplemental Electrode(s):
  - 1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes, provide jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
  - 2. Provide a supplemental ground electrode and bond to the grounding electrode system.
- C. Service Disconnect (Separate Individual Enclosure): Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors.
- D. Switchgear, Switchboards, Unit Substations, Panelboards, Engine-Generators, and Automatic Transfer Switches:
  - 1. Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
  - 2. For service entrance equipment, connect the grounding electrode conductor to the ground bus.
  - 3. Provide ground bars, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.
  - 4. Connect metallic conduits that terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.

### **3.4 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. 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 bare 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 100% electrical continuity throughout the wireway system, by connecting a No. 6 AWG [16 mm<sup>2</sup>] bonding jumper at all intermediate metallic enclosures and across all section junctions.
  - 2. Install insulated No. 6 AWG [16 mm<sup>2</sup>] bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 50 ft [16 M].
  - 3. Use insulated No. 6 AWG [16 mm<sup>2</sup>] 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 [16 mm<sup>2</sup>] bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 49 ft [15 M].
- 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 when the green ground is provided; otherwise, ground the fixtures through the conduit systems. 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 [16 mm<sup>2</sup>]. These conductors shall be installed in rigid metal conduit.

### **3.5 OUTDOOR METALLIC FENCES AROUND ELECTRICAL EQUIPMENT**

- A. Outdoor Metallic Fences Around Electrical Equipment: Fences shall be grounded with a ground rod at each fixed gate post and at each corner post. Drive ground rods until the top is 12 in [300 mm] below grade. Attach a No. 4 AWG [25 mm<sup>2</sup>] copper conductor by exothermic weld to the ground rods, and extend underground to the immediate vicinity of fence post. Lace the conductor vertically into 12 in [300 mm] of fence mesh and fasten by two approved bronze compression fittings, one to bond the wire to post and the other to bond the wire to fence. Each gate section shall be bonded to its gatepost by a 0.375 in x 1 in [3 mm



x 25 mm] flexible, braided copper strap and ground post clamps. Clamps shall be of the anti-electrolysis type.

### **3.6 CORROSION INHIBITORS**

When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces.

Use corrosion inhibitor appropriate for protecting a connection between the metals used.

### **3.7 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 gases and suction piping, at the outlets, directly to the room or patient ground bus.

### **3.9 LIGHTNING PROTECTION SYSTEM**

As applicable, Bond the lightning protection system to the electrical grounding electrode system.

### **3.10 ELECTRICAL ROOM GROUNDING**

- A. Building Earth Ground Busbars: Provide ground busbar and mounting hardware at each electrical room and connect to pigtail extensions of the building grounding system.

### **3.11 3.12 GROUND RESISTANCE**

- A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.
- B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.
- C. Services at power company interface points shall comply with the power company ground resistance requirements.
- D. Below-grade connections shall be visually inspected by the COTR prior to backfilling. The Contractor shall notify the COTR 72 hours before the connections are ready for inspection.

### **3.12 GROUND ROD INSTALLATION**

- A. For outdoor installations, Drive each rod vertically in the earth, until top of rod is 24 in [609 mm] below final grade.
- B. For indoor installations, leave 4 in [100 mm] of rod exposed.
- C. Where permanently concealed ground connections are required, make the connections by the exothermic process, to form solid metal joints. Make accessible ground connections with mechanical pressure -type ground connectors.

- D. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

--- E N D ---

**SECTION 26 05 41**  
**UNDERGROUND ELECTRICAL CONSTRUCTION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and connection of precast manholes and pullboxes with ducts to form a complete underground raceway system.
- B. "Duct" and "conduit," and "rigid metal conduit" and "rigid steel conduit" are used interchangeably in this specification.

**1.2 RELATED WORK**

- A. Section 07 92 00, JOINT SEALANTS: Sealing of conduit penetrations.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings and boxes for raceway systems.
- E. Section 31 20 00, EARTH MOVING: Trenching, backfill and compaction.

**1.3 QUALITY ASSURANCE**

- A. Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Coordinate layout and installation of ducts, manholes, pullboxes, and pull-boxes with final arrangement of other utilities, site grading, and surface features, as determined in the field.
- C. Underground Vaults and pull boxes shall not be installed in any permanent drive. Minimum anticipated vaults are indicated on plans in acceptable locations. Additional vaults may be installed at the contractors option providing they comply with these specifications and are located as acceptable to the VAMC.

**1.4 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, furnish the following shop drawings and certifications:
- B. Shop Drawings:
  - 1. Clearly present sufficient information to determine compliance with drawings and specifications.
  - 2. Include manholes, pullboxes, duct materials, and hardware. Submit plan and elevation drawings, showing openings, pulling irons, cable supports, cover, ladder, sump, and other accessories and details.
  - 3. Proposed deviations from details on the drawings shall be clearly marked on the submittals. If it is necessary to locate manholes or pullboxes at locations other than shown on the drawings, show the proposed locations accurately on scaled site drawings, and submit four copies to the COTR for approval prior to construction.

- C. Certifications: Three (3) weeks prior to the final inspection, submit four copies of the following certifications to the COTR:
1. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
  2. Certification by the Contractor that the materials have been properly installed, connected, 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 Concrete Institute (ACI):
- Building Code Requirements for Structural Concrete
- 318/318M-05.....Building Code Requirements for Structural Concrete & Commentary
- SP-66-04.....ACI Detailing Manual
- C. American National Standards Institute (ANSI):
- 77-07 .....Underground Enclosure Integrity
- D. American Society for Testing and Materials (ASTM):
- C478-09.....Standard Specification for Precast Reinforced Concrete Manhole  
Sections
- C858-09.....Underground Precast Concrete Utility Structures
- C990-09.....Standard Specification for joints for concrete pipe, Manholes and  
Precast Box Sections Using Preformed flexible Joint sealants.
- E. Institute of Electrical and Electronic Engineers (IEEE):
- C2-07 .....National Electrical Safety Code
- F. National Electrical Manufacturers Association (NEMA):
- TC 2-03 .....Electrical Polyvinyl Chloride (PVC) Tubing And Conduit
- TC 3-2004 .....PVC Fittings for Use With Rigid PVC Conduit And Tubing
- TC 6 & 8 2003.....PVC Plastic Utilities Duct For Underground Installations
- TC 9-2004 .....Fittings For PVC Plastic Utilities Duct For Underground Installation
- G. National Fire Protection Association (NFPA):
- 70-08 .....National Electrical Code (NEC)
- H. Underwriters Laboratories, Inc. (UL):
- 6-07 .....Electrical Rigid Metal Conduit-Steel
- 467-07 .....Grounding and Bonding Equipment
- 651-05 .....Schedule 40 and 80 Rigid PVC Conduit and Fittings
- 651A-00.....Type EB and A Rigid PVC Conduit and HDPE Conduit
- 651B-07.....Continuous Length HDPE Conduit

## **PART 2 - PRODUCTS**

### **2.1 GROUNDING**

- A. Rods: Per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS and UL 467
- B. Ground Wire: Stranded bare copper 16 mm<sup>2</sup> (6 AWG) minimum.

### **2.2 WARNING TAPE:**

- A. Standard 4-mil polyethylene 76 mm (3 inch) wide tape, detectable type, red with black letters, imprinted with "CAUTION BURIED ELECTRIC CABLE BELOW".

### **2.3 PULLBOXES**

- A. General: Size minimum as indicated on drawings and required by code. Provide pullboxes with weatherproof, non-skid covers with recessed hook eyes, secured with corrosion- and tamper-resistant hardware. Cover material shall be identical to pullbox material. Covers shall have molded lettering, ELECTRIC or SIGNAL as applicable. Pullboxes shall comply with the requirements of ANSI/SCTE 77 Tier 5 loading. Provide pulling irons, 0.875 in [22 mm] diameter galvanized steel bar with exposed triangular-shaped opening.
- B. Fiberglass Pullboxes: Shall be sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

### **2.4. DUCTS**

- A. Number and sizes shall be as shown on drawings and required by code.
- B. Ducts (concrete-encased):
  - 1. Plastic Duct:
    - a. NEMA TC6 & 8 and TC9 plastic utilities duct UL 651 and 651A Schedule 40 PVC.
    - b. Duct shall be suitable for use with 194° F [90° C] rated conductors.
  - 2. Conduit Spacers: Prefabricated plastic.

## **GROUNDING**

- A. Rods: Per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- B. Ground Wire: Stranded bare copper 6 AWG [16 mm<sup>2</sup>] minimum.

### **2.5 WARNING TAPE**

Standard 4-mil polyethylene 3 in [76 mm] wide detectable tape, red with black letters, imprinted with "CAUTION - BURIED ELECTRIC CABLE BELOW" or similar.

### **2.6 PULL ROPE** for spare ducts

Plastic with 200 lb [890 N] minimum tensile strength.

## **PART 3 - EXECUTION**

### **3.1 PULLBOX INSTALLATION**

- A. Assembly and installation shall follow the printed instructions and recommendations of the manufacturer. pullboxes level and plumb.

1. Units shall be installed on a 12 in [300 mm] level bed of 90% compacted granular fill, well-graded from the 1 in [25 mm] sieve to the No. 4 sieve. Granular fill shall be compacted with a minimum of four passes with a plate compactor.
2. Seal duct terminations so they are watertight.

**B ACCESS: ENSURE THE TOP OF FRAMES AND COVERS ARE FLUSH WITH FINISHED GRADE.3.2 TRENCHING**

**3.2 TRENCHING**

- A. Refer to Section 31 20 11 EARTH MOVING for trenching, backfilling, and compaction.
- B. Before performing trenching work at existing facilities, the Ground Penetrating Radar Survey shall be carefully performed by certified technician to reveal all existing underground ducts, conduits, cables, and other utility systems.
- B. Work with extreme care near existing ducts, conduits, cables, and other utilities to avoid damaging them. Prior to commencing of any underground electrical work, utility locates shall be performed and site record plan, to scale, shall be maintained on the project site.
- C. Cut the trenches neatly and uniformly. Secure route verification from the VA prior to trenching.
- D. For Concrete -Encased Ducts:
  1. After excavation of the trench, stakes shall be driven in the bottom of the trench at 4 ft [1.2 M] intervals to establish the grade and route of the duct bank.
  2. Pitch the trenches uniformly toward manholes or both ways from high points between manholes for the required duct line drainage. Avoid pitching the ducts toward buildings wherever possible.
  3. The walls of the trench may be used to form the side walls of the duct bank, provided that the soil is self-supporting and that concrete envelope can be poured without soil inclusions. Forms are required where the soil is not self-supporting.
  4. After the concrete -encased duct has sufficiently cured, the trench shall be backfilled to grade with earth, and appropriate warning tape installed.
- E. Conduits to be installed under existing paved areas and roads that cannot be disturbed shall be jacked into place. Conduits shall be heavy wall rigid steel.

**3.3 DUCT INSTALLATION**

**A. General Requirements:**

1. Ducts shall be in accordance with the NEC and IEEE C2, as shown on the drawings, and as specified.
2. Slope ducts to drain away from manholes and pullboxes, and away from building and equipment entrances. Pitch not less than 4 in [100 mm] in 100 ft [30 M].
3. Underground conduit stub-ups and sweeps to equipment inside of buildings shall be taped galvanized rigid steel, and shall extend a minimum of 5 ft [1.5 M] outside the building foundation. Tops of conduits below building slab shall be minimum 24 in [610 mm] below bottom of slab.
4. Stub-ups, sweeps, and risers to equipment mounted on outdoor concrete slabs shall be taped galvanized rigid steel, and shall extend a minimum of 5 ft [1.5 M] away from the edge of slab.

5. Install insulated grounding bushings on the terminations.
  6. Radius for turns of direction shall be sufficient to accomplish pulls without damage. Minimum radius shall be six times conduit diameter. Use manufactured long sweep bends.
  7. Additional burial depth shall be required in order to accomplish NEC-required minimum bend radius of ducts.
  8. All multiple conduit runs shall have conduit spacers. Spacers shall securely support and maintain uniform spacing of the duct assembly a minimum of 3 in [75 mm] above the bottom of the trench during the concrete pour. Spacer spacing shall not exceed 5 ft [1.5 M]. Secure spacers to ducts and earth to prevent floating during concrete pour. Provide nonferrous tie wires to prevent displacement of the ducts during pouring of concrete. Tie wires shall not act as substitute for spacers.
  9. Duct lines shall be installed no less than 12 in [300 mm] from other utility systems, such as water, sewer, and chilled water.
  10. Clearances between individual ducts:
    - a. For like services, not less than 3 in [75 mm].
    - b. For power and signal services, not less than 6 in [150 mm].
  11. Duct lines shall terminate at window openings in manhole walls as shown on the drawings. All ducts shall be fitted with end bells.
  12. Couple the ducts with proper couplings. Stagger couplings in rows and layers to ensure maximum strength and rigidity of the duct bank.
  13. Keep ducts clean of earth, sand, or gravel, and seal with tapered plugs upon completion of each portion of the work.
  14. Seal conduits, including spare conduits, at building entrances and at outdoor equipment terminations with a suitable compound to prevent entrance of moisture and gases.
- B. Concrete -Encased Ducts and Conduits:
1. Install concrete -encased ducts for medium-voltage systems, low -voltage systems, and signal systems.
  2. Duct lines shall consist of single or multiple duct assemblies encased in concrete. Ducts shall be uniform in size and material throughout the installation.
  3. Tops of concrete-encased ducts shall be:
    - a. Not less than 24 in [600 mm] and not less than shown on the drawings, below finished grade.
    - b. Not less than 30 in [750 mm] and not less than shown on the drawings, below roads and other paved surfaces.
    - c. Conduits crossing under grade slab construction joints shall be installed a minimum of 4 ft [1.2 M] below slab.
  4. Extend the concrete envelope encasing the ducts not less than 3 in [75 mm] beyond the outside walls of the outer ducts and conduits.
  5. Within 10 ft [3 M] of building manhole and pullbox wall penetrations, install reinforcing steel bars at the top and bottom of each concrete envelope to provide protection against vertical shearing.

6. Install reinforcing steel bars at the top and bottom of each concrete envelope of all ducts underneath roadways and parking areas.
7. Where new ducts, conduits, and concrete envelopes are to be joined to existing manholes, pullboxes, ducts, conduits, and concrete envelopes, make the joints with the proper fittings and fabricate the concrete envelopes to ensure smooth durable transitions.
8. Conduit joints in concrete may be placed side by side horizontally, but shall be staggered at least 6 in [150 mm] vertically.
9. Pour each run of concrete envelope between terminations in one continuous pour. If more than one pour is necessary, terminate each pour in a vertical plane and install 0.75 in [19 mm] reinforcing rod dowels extending 18 in [450 mm] into concrete on both sides of joint near corners of envelope.
10. Pour concrete so that open spaces are uniformly filled. Do not agitate with power equipment unless approved by COTR.
11. Duct Bank Markers:
  - a. Duct bank markers, where required and shown on plans, shall be located at the ends of duct banks except at manholes or pullboxes at approximately every 200 ft [60 M] along the duct run and at each change in direction of the duct run. Markers shall be placed 2 ft [0.6 M] to the right of the duct bank, facing the longitudinal axis of the run in the direction of the electrical load.
  - b. The letter "D" with two arrows shall be impressed or cast on top of the marker. One arrow shall be located below the letter and shall point toward the ducts. The Second arrow shall be located adjacent to the letter and shall point in a direction parallel to the ducts. The letter and arrow adjacent to it shall each be approximately 2 in [75 mm] long. The letter and arrows shall be V-shaped, and shall have a width of stroke at least 0.75 in [6 mm] at the top and a depth of 0.25 in [6 mm].
  - c. In paved areas, the top of the duct markers shall be flush with the finished surface of the paving.
  - d. Where the duct bank changes direction, the arrow located adjacent to the letter shall be cast or impressed with an angle in the arrow equivalent to the angular change of the duct bank.//
- D. Concrete-Encased Duct and Conduit Identification: Place continuous strip of warning tape approximately 12 in [300 mm] above ducts or conduits before backfilling trenches. Warning tape shall be preprinted with proper identification.
- E. Spare Ducts and Conduits: Where spare ducts are shown, they shall have a nylon pull rope installed. They shall be capped at each end and labeled as to location of the other end.
- F. Duct and Conduit Cleaning:
  1. Upon completion of the duct installation, a standard flexible mandrel shall be pulled through each duct to loosen particles of earth, sand, or foreign material left in the duct. The mandrel shall be not less than 12 in [3600 mm] long, and shall have a diameter not less than 0.5 in [13 mm] less than the inside diameter of the duct. A brush with stiff bristles shall then be pulled through each duct to remove the



- loosened particles. The diameter of the brush shall be the same as, or slightly larger than the diameter of the duct.
2. Mandrel pulls shall be witnessed by the COTR.
- G. Duct and Conduit Sealing: Seal the ducts and conduits at building entrances, and at outdoor terminations for equipment, with a suitable non-hardening compound to prevent the entrance of moisture and gases.
- H. Connections to Existing Ducts: Where connections to existing duct banks are indicated, excavate around the duct banks as necessary. Cut off the ducts and remove loose concrete from inside before installing new ducts. Provide a reinforced-concrete collar, poured monolithically with the new ducts, to take the shear at the joint of the duct banks.
- K. Partially-Completed Duct Banks: During construction, wherever a construction joint is necessary in a duct bank, prevent debris such as mud and dirt from entering ducts by providing suitable conduit plugs. Fit concrete envelope of a partially completed duct bank with reinforcing steel extending a minimum of 2 ft [0.6 M] back into the envelope and a minimum of 2 ft [0.6 M] beyond the end of the envelope. Provide one No. 4 bar in each corner, 3 in [75 mm] from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately 12 in [300 mm] apart. Restrain reinforcing assembly from moving during pouring of concrete.

--- E N D ---

**SECTION 26 05 53**  
**IDENTIFICATION AND LABELING**

**PART I - GENERAL**

**1.1 DESCRIPTION**

- A. This section includes labor, material, equipment, and related services necessary to furnish and install identification labels on electrical equipment and wiring as indicated on the drawings and as specified herein. All labeling, identification, and markings shall comply with equipment manufacturer requirements, ANSI C2, the latest versions of the NEC and OSHA standards, specific labeling requested by the authority having jurisdiction, NFPA, VA and applicable healthcare "Joint Commission" and State Department of Health requirements.
- B. This section provides VAMC required labeling and is in addition to all identification, labels and signs that are required by OSHA, ANSI, NFPA and other codes.
- C. See Division 26 specifications for additional miscellaneous equipment identifications and labeling requirements.

**1.2 SHOP DRAWINGS**

- A. Submit a complete list of identification labels for all panels, disconnect, and equipment. The list shall be updated and verified with the Engineer and/or Owner prior to manufacture of these labels to reflect changes made during the construction of the project.

**1.3 QUALITY ASSURANCE**

- A. All work shall be performed in a neat workmanship manner.
- B. Comply with applicable ANSI, NFPA and other codes. Refer to NFPA 70 (NEC) for color-coding and utilize the same color coding throughout the project. Utilize color coding which is consistent with any existing facilities providing they comply with code requirements.
- C. Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

**1.4 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, furnish the following:
  - 1. Manufacturer's Literature and Data: Showing listing and ratings of materials proposed.
  - 2. Submit a complete listing of proposed identification material and proposed nameplate and associated language. Labels provided shall include those required for all receptacles, starters, controls, panels, etc. Prior to manufacture, equipment labels for the project shall be presented to the COTR representative in a line-by-line listing in EXCEL or another acceptable format to the COTR.
  - 3. Certifications: Three weeks prior to the final inspection, submit four copies of the following certifications to the COTR:

- a. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.

## **PART II - PRODUCTS**

### **2.1 LAMINATED PLASTIC NAMEPLATES**

- A. Engraved Plastic Nameplates and Signs: Engraving stock shall be 1/16" thick for signs up to 20 square inches and 1/8" thick for larger signs. Laminate plastic plates shall be black-white for normal systems and red-white for emergency systems. Characters shall be cut through the black or red to show the white of the plate. Inscriptions shall be symmetrical to the centerline of plates. Single line plates shall have minimum 1/4" high letters. Multiple line plates shall have minimum 1/8" high letters. Verify wording for all labels before ordering, and use area identification terminology as directed.
- B. Plastic equipment labels stock shall be similar and equal to Rowmark Ultra matte Series 300.

### **2.2 STAINLESS STEEL PLATES**

- A. Where shown on plans as required, stainless steel plates shall be type 302 satin finish. Inscriptions shall be a minimum of 1/4 inch high by engraving filled with black engravers enamel or black silkscreen lettering.

### **2.3 WIRE MARKERS**

- A. Wire markers shall be self-adhesive write-on tape with clear adhesive over-wrap, as manufactured by Brady Manufacturing, T & B, Panduit, or Ideal.
- B. Embossed adhesive tape shall not be used.

### **2.4 UNDERGROUND PLASTIC WARNING TAPE**

- A. Plastic tape shall be listed for intended service, inert plastic, not less than 3 inches wide and 4 mils thick, red colored with the words "Caution Buried Electric Lines Below" repeatedly printed along the length of the tape. Tape shall be Panduit or equal.

## **PART III - EXECUTION**

### **3.1 INSTALLATION**

- A. Installation of identification/labels shall be performed as soon as is practical. The contactor shall remain responsible to replace labels damaged during the balance of the construction.
- B. Identification materials and products shall be affixed / applied to equipment, etc such that the label may be viewed without disrupting operation of the equipment.

### **3.2 FASTENING OF NAMEPLATES / SIGNS**

- A. Interior and exterior laminated plastic nameplates and signs shall be attached to the equipment or device by double-backed PE foam-style (Rub) outdoor-rated adhesive tape equal to that manufactured by JDS Industries (800-843-8853). Surfaces MUST be clean and dry prior to applying the self-adhesive tape.
- B. Alternatively, self-tapping stainless steel pan-head screws may be used to affix interior labels and permanently bonding epoxy glue may be used to affix exterior labels. Panhead screws may NOT be used for fastening nameplates to exterior equipment and epoxy glue may NOT be used to affix interior labels.

### **3.3 INSCRIPTIONS**

- A. Inscription characters on the switchboard, panelboards, metering, terminal cabinets and fuse storage cabinet, unless otherwise noted, shall be minimum 1/4 inch high. Inscription characters on other identification plates shall be minimum 1/8 inch high.

### 3.4 NORMAL EQUIPMENT-IDENTIFICATION

- A. Certain types of equipment, controls, and switchplates are to be labeled with identifying words, names, numbers or characters. Hand printing shall not be used where permanently visible. All identifications shall be performed with a laminated plastic nameplates sized appropriately for the equipment to be labeled, and as a minimum, shall be as specified below and as acceptable to the owner:
  - 1. In addition to the following requirements, every protective device which is a series-rated over-current device shall be labeled as such consistent with the latest version of the NEC.
  - 2. Motor or heater control devices - manual motors switches, motor toggle switches, pushbuttons, thermostats, etc. Nameplate inscriptions shall indicate the equipment being controlled, i.e. "Toilet Exh, Range Hood Exh, Heater, A.C. Unit # 1, H.W. Pump #2", etc. as described in the mechanical/electrical schedule or as indicated on drawings, and the branch circuit source, i.e. "Panel L1-2".
  - 3. Motor or heater disconnects and starters - each safety switch, toggle switch, or starter, shall be identified. Nameplate inscriptions shall indicate the equipment being controlled defined by its motor number as listed in the mechanical/electrical schedule or as indicated on the drawings, i.e. "Toilet Exh (PRV- 1), Heater (UH-3), A.C. Unit #1 (RTU-2)", etc. and to include the branch circuit source, i.e. "Panel L1-2". EXAMPLE: EF-1, 120V, 1ø, 3W/CKT #5 MDP MECH ROOM-101. In addition, series rated over-current devices shall be labeled as required by the latest version of the NEC. EXAMPLE: EF-1, 120V, 1ø, 3W/CKT #5 MDP MECH ROOM-101. Where rating of fuse disc/switch exceeds the ampacity of the conductors being protected, a permanent label noting maximum fuse size shall be installed inside switch and listed on exterior label.
  - 4. Call bell pushbuttons, door release pushbuttons, alarm pushbuttons, or other similar systems input/control stations, etc. shall be identified. Nameplate inscriptions shall indicate the function of the device, i.e. "Call Bell, Door Release, Silent Alarm", unless noted otherwise on the drawings.
  - 5. Switchboards, Motor Control Centers and Panelboards – Panel labels shall be provided on the outside of each panelboard in mechanical and electrical equipment rooms and on the inside of the door of each panelboard located in other finished areas. Inscriptions shall indicate the panel name, voltage, phase, # wires, feeder size, and feeder source, i.e.: "Panel L1, 120/208-3PH-4W, 3#2 & 1#8 GRD THHN, fed from Panel H1." At the contractor's option, separate labels defining feeder size may be located on the inside of operable doors. All wild legs shall be identified per the NEC. Where existing panels are modified, the contractor shall provide the VA with a computer printed directory showing the as built condition.
  - 6. In addition, where the premises wiring system has branch circuits supplied from more than one nominal voltage system, each conductor shall be identified with a phase designation in agreement with

a laminated nameplate attached to the front of panelboards, switchboards, junction boxes or motor control centers. The nameplates for two systems shall indicate:

120/208V 3PH. 4W SYSTEM
PHASE A - BLACK
PHASE B - RED
PHASE C - BLUE
NEUTRAL - WHITE

- 7 . In addition, a laminated nameplate attached to the front of main panelboard shall be labeled with the following, as applicable.

<u>120/208V 3PH. 4W SYSTEM</u>
PHASE A - BLACK
PHASE B - RED
PHASE C - BLUE
NEUTRAL - WHITE

- 8 . Dry-Type Transformers - Nameplates shall be provided which shall indicate the name of the transformer, and primary feeder size and source, i.e. "TF-1, #1 & 1 #8 GRD, fed from Panel H1."
- 9 . Bus Duct - Nameplates shall be provided every 50 feet along the length of the bus duct which shall indicate the name of bus duct, voltage, phase and neutral, bus size, and the source and feeder size, i.e. "BD-1, 277/480V, 3 phase, 4W, (2) sets 3 ½ inches-4 #500 MCM & 1 #1/0 GRD, fed from MSB-1." Nameplate lettering shall be minimum ½" high. Nameplates on bus plugs shall be installed to face the floor.
- 10 . Time switches, contactor cabinets, automatic lighting controls, shall be identified. Inscriptions shall indicate the equipment controlled, i.e. "Parking Lot Lights, Night Lights, Ext. Security Lights, Night Set Back Control", etc.
- 11 . Devices: Note the panel and circuit number on the inside of the pull/j-box.
- 12 . Systems pull/j-box: Paint blank covers with the following colors: telephone/data: green, fire alarm: red, television: white.

### **3.5 EMERGENCY EQUIPMENT-IDENTIFICATION**

- A. Electrical equipment that is connected to the building emergency system shall be labeled as specified herein (red as applicable) and in addition, shall be clearly labeled by supplemental nameplate as "Life-Safety System", "Equipment Power System", or "HVAC Equipment System" as applicable. In addition, each label shall indicate the panel and circuit number at the bottom of the nameplate (for example 7EQ – 5, for circuit 5). See Section 26 27 26, WIRING DEVICES.

### **3.6 EMERGENCY SYSTEM DEVICE WALLPLATES -LABELING**

- A. Emergency branch circuit devices shall be identified as may be further required elsewhere in these specifications, by the NEC, the VA, other applicable NFPA codes and if applicable, the healthcare industry Joint Commission and State Department of Health. See Section 26 27 26, WIRING DEVICES.
- B. All device wallplates connected to emergency power systems shall be labeled to define the emergency power system from which it is powered and identify the panel and branch circuit source, i.e. "Equipment Power" at the top of the wall plate and "L1-2" at the bottom of the wall plate.

### **3.7 SWITCHBOARDS, PANELBOARDS, MCCs DIRECTORIES**

- A. Per the NEC, every branch circuit and circuit modification shall be legibly identified as to its clear, evident, and specific purpose or use. The individual circuit identification shall include sufficient detail to allow each circuit to be distinguished from all others. Install computer generated circuit directories to indicate the branch loads served in panelboards. The identification shall be included in a circuit directory that is located on the inside of the panel door in the case of a panelboard, and located at each switch on a switchboard or MCC. Circuit nameplates shall indicate the device powered, i.e. "Panel LI, HVAC Unit #1, Capacitors", etc.
- B. Provide computer generated directories in all new and existing panels. At the conclusion of the project provide the owner with a computer file with all as-installed conditions.
- C. Directories in existing panels where circuits have been modified, added or deleted shall be modified to reflect the final as-built condition. At the conclusion of the work, turn over old directories to the owner.
- D. The directory shall also identify the date the directory was installed and the installation contractor name.

### **3.8 CONDUITS AND JUNCTION BOXES – LESS THAN 600V**

- A. In junction boxes and pull boxes, carrying conductors less than 600 volts (including all branch circuit conductors) the boxes shall be identified by marking inside the box not on the box cover **and** on the face of the box cover with black indelible "Magic Marker" to indicate circuit numbers of the conductors contained in the box (i.e.,: "B-2, 4, 6").
- B. New conduits and all conduits in which emergency branches conduits and /or wiring have been revised shall be identified with the following color scheme by painting the cover of the all junction boxes per the following scheme.
  - a. Fire Detection – RED
  - b. ESS Life Safety – Yellow
  - c. Emergency Equipment Branch – Pink
  - d. Voice / Telephone – Blue
  - e. Data – Green
  - f. TV – White

### **3.9 RACEWAYS –SPECIAL CONDITIONS - LESS THAN 600V**

- A. Label raceways at entry to any enclosure supplied/fed from any nominal voltage system. Each conduit shall be identified with black indelible "Magic Marker" written or stenciled to indicate the circuit number, voltage/phase of the sources contained in the raceway and where more than one nominal voltage system enters an enclosure, the conductor color coding scheme employed shall also be indicated. (i.e.,: "B-2, 4,

120/208V 3PH. 4W, A-BLK, B-RED, C-BLUE, NEUTRAL – WHT”). Labeling shall be neat and legible. The VA and the engineer retain the right to require the label to be stenciled onto the conduit.

- B. Empty/Spare raceway at the conclusion of the project must contain a pull string with opposite end labeling and typed description of the purpose of the raceway and the location of the opposite end. Provide the owner with a computer generated spreadsheet indicating any/all empty raceway, size of raceway, tag/label description of purpose, location of opposite ends and associated conduit size(s). Spreadsheet shall also indicate exact locations where raceway size reduces or increases.

### **3.10 EQUIPMENT -ARC FLASH**

- A. Panelboards, switchboards, motor starters, fused disconnect switches, industrial control panels, motor control centers and other electrical equipment located in other than dwelling units which may require service while energized shall be labeled to warn of potential arc-flash per NEC 110.16 as acceptable to the local Authority Having Jurisdiction (AHJ). The label may be laminated plastic nameplates, or preprinted self-adhesive warning label. In either case, the label shall be approved by the local AHJ.

### **3.11 DATA/COMMUNICAITONS -LABELING**

- A. Provide labeling for data and telecommunications system in full accordance with the latest NEC, BICSI Standards, consistent with owner labeling preferences, and/or as may be further required in other project specification sections.

### **3.12 WARNING, CAUTION AND INSTRUCTION SIGNS**

- A. At a minimum, apply warning and caution signs as required by OSHA, NFPA 70 and NFPA 70E.

### **3.13 OTHER REQUIREMENTS**

- A. In addition to the equipment/system labeling required herein, the NEC may require specific labeling for the following: Access doors to electrical systems, substations, power transfer equipment, contactors, dimmers, inverters, UPS's, battery equipment, power generation units, telephone and communications equipment, nurse call and other healthcare systems, TV antennae systems, fire alarm systems, and security systems. The contractor is to be familiar with and perform the required labeling.

### **3.14 CONDUCTORS -IDENTIFICATION**

- B. Branch circuit conductors shall be identified as follows:
  - 1. In junction boxes and pull boxes - where splicing has been implemented, (splicing should be approved by the project documentation) all conductors shall be identified by a full-wrap self-adhesive wire-marker to indicate panelboard circuit number (i.e.: "L1-2").

- - - END - - -

**SECTION 26 08 00****COMMISSIONING OF ELECTRICAL SYSTEMS****PART 1 - GENERAL****1.1 DESCRIPTION**

- A. The requirements of this Section apply to all sections of Division 26.
- B. This project will be overseen by a third party commissioning agent with selected building systems commissioned. A partial list of equipment and systems to be commissioned are specified herein. Typical systems commissioning, which the Contractor is responsible to execute as it applied to systems within this facility, are defined in the VA commissioning manual. A third party Commissioning Agent (CxA) hired directly by the Department of Veterans Affairs will provide commissioning oversight and will generally manage the commissioning process in general accordance with the Commissioning Manual, Sample Commissioning Plan, etc.
- C. The contractor shall participate in the planning and scheduling of all commissioning in accordance with the VA Commissioning Manual.
- D. The contractor shall bid to perform and report all required testing/commissioning as applicable by the VA Commissioning Manual. The manual can be found at: <http://downloads.va.gov/filemgr/> - within folder CFM-TIL/commissioning and as indicated herein.
- E. The contractor shall bid and be prepared to participate by providing documentation for the Final Commissioning Report. This may include some warranty period Checks and/or demonstrations.

**1.2 RELATED WORK**

- A. Section 01 00 00 GENERAL REQUIREMENTS.
- B. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS
- D. Section 26 24 DISTRIBUTION SWITCHBOARDS

**1.3 SUMMARY**

- A. This Section includes requirements for commissioning, testing and reporting thereof for the electrical systems, subsystems and equipment as anticipated to provide complete commissioning. This section supplements the general commissioning requirements specified in Section 01 91 00.
- B. The commissioning activities herein have been developed to support the VA requirements to meet guidelines relative to VA standards.



- C. Electrical systems requiring commissioning will require several steps to be completed in the commissioning process. Those steps will include Pre-Functional Checklist, Equipment Startup, Functional Testing, and Approved documentation and reporting for each step.
- D. Refer to the VA Commissioning Manual for more specifics regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

#### **1.4 DEFINITIONS**

- A. Refer to VA Commissioning Manual and Section 01 for definitions.

#### **1.5 COMMISSIONED SYSTEMS**

- A. Commissioning of a system or systems specified in this Division is part of the construction process. Testing, Witnessing and Documentation of these systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.
- B. At a minimum, the following Electrical systems will be commissioned:
  1. Utility Service Entrance Switchboards and Panels (Fuses and circuit breaker settings, metering, mimic diagram, gages, and controls).
  2. Generator Systems (Utility phase rotation, Automatic transfer switches, fuel delivery pumps and motors, battery charging and instrumentation, muffler and exhaust system, and vibration isolation).
  3. Generator Power Distribution Systems (Fuses and circuit breaker settings, metering, gages, and controls).
  4. Automatic Transfer Switches (Test with associated generator).
  5. Normal Power Distribution Systems (Grounding tests, major circuit breaker settings, meters and gages, and controls).
  6. Life Safety Power Distribution Systems (Automatic transfer on loss of normal power, grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
  7. Critical Power Distribution Systems (Automatic transfer on loss of normal power, grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
  8. Essential Equipment Power Distribution Systems (Automatic transfer on loss of normal power, grounding tests, coordination study review, major circuit breaker settings, meters and gages, and controls).
  9. Egress lighting operation checks.

C. Reports for Commissioning of the system shall be prepared on NFPA report forms or a VA Standard Form (see VA Commissioning Manual for Sample Forms) as determined most desirable by the Commissioning agent. The reports shall also include and be equal to, but are not limited to the following forms:

1. Disconnects, NFPA form 70B, 60.
2. Overload Relays, NFPA form 70B, 64.
3. Power Meters, NFPA form 70B, 67.
4. Panelboards, NFPA form 70B, 68.
5. Generator Inspection, NFPA form 70B, 76.
6. Automatic and Manual (as applicable) Transfer Switches, NFPA form 70B, 77.
7. Emergency Power System, NFPA form 70B, 79.
8. Cable Insulation, NFPA forms 70B, 80, 81, 82.
9. Ground System Resistance, NFPA form 70B, 85.
10. Torque Record, NFPA form 70B, 87.
11. Mains Energization Checklist, NFPA form 70B, 88.
12. Ground Tests Inspection Report, NFPA form 70B, 91.
13. Genset Survey, NFPA form 70B, 109.
14. Low Voltage Breakers Record, NFPA form 70B, 126
15. Thermal imaging after 2 months of operation.

D. Manufacturer Standard Testing/Reports shall also be performed and reported. The requirements for Commissioning shall not reduce the manufacturer's standard testing procedures and reporting.

#### 1.6 SUBMITTALS

- A. The commissioning process requires submittal and scheduling of intended testing and reporting **prior** to the performance. The 3<sup>rd</sup> party Commissioning Agent will provide a final list of submittals that will be reviewed by the Commissioning Agent (CxA), Engineer, and/or Owner. Refer to Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS for further details.
- B. The commissioning process requires Submittal review simultaneously with engineering review.
- C. The contractor shall submit both VA required commission information and the manufacturer's standard commissioning/checklist information and reports.

**1.7 COMMISSIONING REQUIREMENTS & OVERSIGHT**

- A. The commissioning process requires review of selected submittals. The Commissioning Agent will coordinate with the contractor and Engineer to verify the final list of submittals that will be required by the installation. This list will be reviewed and approved by the COTR prior to forwarding to the Contractor.
- B. The contractor shall include in the bid scheduled time for proper execution of commissioning and oversight thereof per the project requirements and the VA Commissioning Manual.
- C. The contractor shall include in the bid, all work related items indicated in specifications and VA Commissioning Manual.

**PART 2 - PRODUCTS (NOT USED)****PART 3 - EXECUTION****3.1 PRE-FUNCTIONAL CHECKLISTS**

- A. The Contractor shall complete all Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists with oversight by the commissioning agent. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review/approval. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to Section 01 90 00 and the VA Commissioning Manual for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

**3.2 CONTRACTORS TESTS**

- A. Contractor tests as required by other sections of Division 26 shall be scheduled and documented in accordance with 01 00 00, 01 90 00, and the

Commissioning Agent instruction. The Commissioning Agent will witness selected Contractor tests and may, if any test is deemed compromised, require the contractor to re-test. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

### **3.3 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:**

- A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent may prepare detailed Systems Functional Performance Test procedures for review and approval by the COTR and Engineer. The Contractor shall review and comment on the tests prior to testing. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 90 00 and the VA Commissioning Manual for additional details.

### **3.4 TRAINING OF VA PERSONNEL**

- A. Training of the VA's operation and maintenance personnel is required of the contractor in cooperation with the COTR and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the COTR after submission and approval of formal training plans. Refer to VA Commissioning Manual and Division 26 Sections for additional Contractor training requirements.

----- END -----

## **SECTION 26 29 21 DISCONNECT SWITCHES**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

This section specifies the furnishing, installation, and connection of low voltage disconnect switches.

#### **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 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES 600 VOLTS AND BELOW: Cables and wiring.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground faults.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.

#### **1.3 QUALITY ASSURANCE**

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

#### **1.4 SUBMITTALS**

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, furnish the following:
- B. Shop Drawings:
  - 1. Clearly present sufficient information to determine compliance with drawings and specifications.
  - 2. Include electrical ratings, dimensions, mounting details, materials, enclosure types, and fuse types and classes.
  - 3. Show the specific switch and fuse proposed for each specific piece of equipment or circuit.
- C. Manuals:
  - 1. Provide complete maintenance and operating manuals for disconnect switches, including technical data sheets, wiring diagrams, and information for ordering replacement parts. Deliver four copies to the COTR three (3) prior to final inspection.
  - 2. Identify terminals on wiring diagrams to facilitate maintenance and operation.
  - 3. Wiring diagrams shall indicate internal wiring and any interlocking.
- D. Certifications: Three (3) weeks prior to the final inspection, submit four copies of the following certifications to the COTR:
  - 1. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
  - 2. Certification by the contractor that the materials have been properly installed, connected, and tested.

## 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. National Electrical Manufacturers Association (NEMA):
  - FU 1-07 .....Low Voltage Cartridge Fuses
  - KS 1-06 .....Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
- C. National Fire Protection Association (NFPA):
  - 70-08 .....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
  - 98-04 .....Enclosed and Dead-Front Switches
  - 248-00 .....Low Voltage Fuses
  - 977-94 .....Fused Power-Circuit Devices

## PART 2 - PRODUCTS

### 2.1 LOW VOLTAGE FUSIBLE SWITCHES RATED 600 AMPERES AND LESS

- A. Shall be quick-make, quick-break type in accordance with UL 98, NEMA KS1, and NEC.
- B. Shall have NEMA classification Heavy Duty (HD).
- C. Shall be HP rated.
- D. Shall have the following features:
  - 1. Switch mechanism shall be the quick-make, quick-break type.
  - 2. Copper blades, visible in the OFF position.
  - 3. An arc chute for each pole.
  - 4. External operating handle shall indicate ON and OFF position and have lock open padlocking provisions.
  - 5. Mechanical interlock shall permit opening of the door only when the switch is in the OFF position, defeatable to permit inspection.
  - 6. Fuse holders for the sizes and types of fuses specified.
  - 8. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.
  - 9. Ground Lugs: One for each ground conductor.
  - 10. Enclosures:
    - a. Shall be the NEMA types shown on the drawings for the switches.
    - b. Where the types of switch enclosures are not shown, they shall be the NEMA types most suitable for the ambient environmental conditions. Unless otherwise indicated on the plans, all outdoor switches shall be NEMA 3R.
    - c. Shall be finished with manufacturer's standard gray baked enamel paint over pretreated steel (for the type of enclosure required).
    - d. Enclosures shall be continuous-hinged, side opening and viewing window.

- E. Minimum short circuit rating shall be 200KAIC.
- F. Disconnect shall only be configured for and used for service entrances where specifically indicated on plans. Where required, service-entrance disconnects shall:
  - 1. Listed for service entrance.
  - 2. Be equipped for and comply with: VA Standards, UL, NEC, ANSI, NPFA, etc. for the use.

## **2.2 LOW VOLTAGE UNFUSED SWITCHES RATED 600 AMPERES AND LESS**

Shall be the same as Low Voltage Fusible Switches Rated 600 Amperes and Less, but without provisions for fuses.

## **2.3 LOW VOLTAGE FUSIBLE SWITCHES RATED OVER 600 AMPERES TO 1200 AMPERES**

Shall be the same as Low Voltage Fusible Switches Rated 600 Amperes and Less. These switches shall also be HP rated.

## **2.4 MOTOR RATED TOGGLE SWITCHES**

Refer to Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

## **2.5 LOW VOLTAGE CARTRIDGE FUSES**

- A. In accordance with NEMA FU1. Fuses shall be as indicated or recommended by the protected equipment manufacturer and be cable of interrupting the calculated symmetrical available fault current.
- B. Feeders 1-600 amps: Class R, type LPN-RK.
- C. Main and Feeders 601 amps and above: Class L, type KRP-C.
- D. Motor Branch Circuits: Class R, type LPN-RK.
- E. Other Branch Circuits: Class R, type LPN-RK.
- F. Control Circuits: Class CC, time delay.

## **2.6 IDENTIFICATION**

- A. Install nameplate identification signs on each disconnect switch to identify the equipment controlled and, as applicable, service entrance according to NEC
- B. 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.

# **PART 3 - EXECUTION**

## **3.1 INSTALLATION**

- A. Install disconnect switches in accordance with the NEC and as shown on the drawings.
- B. Fusible disconnect switches shall be furnished complete with fuses. Arrange fuses such that rating information is readable without removing the fuse.

## **3.2 SPARE PARTS**

Two weeks prior to the final inspection, furnish one complete set or 10% , whichever is greater of spare fuses for each fusible disconnect switch installed on the project. In addition, provide fuse pullers for each type and size of fuses. Deliver the spare fuses to the COTR.

--- E N D ---

**SECTION 26 32 13**  
**ENGINE -GENERATORS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the furnishing, installation, and testing of a Emergency Standby engine generator system. This includes, but is not limited to: air filtration, starting system, generator controls, instrumentation, lubrication, fuel system, cooling system, and exhaust system.
- B. The engine generator system shall be fully automatic and shall constitute a unified and coordinated system ready for operation.
- C. Service Qualifications: Due to the somewhat remote location and critical nature of the system function, the engine-generator and ATS supplier(s) shall currently maintain a permanent service organization which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Equipment will NOT be deemed acceptable unless this requirement is able to be complied with. Submit name and address of service organizations, both for the Engine-Generator and the ATS's.
- D. The engine generator system shall include, but not be limited to the following:
  - 1. Propane primary fuel and already install kit for Natural Gas Engine.
  - 2. Lubrication Oil System.
  - 3. Fuel Oil System, Day tank.
  - 4. Cooling System.
  - 5. Intake and Exhaust Air Systems.
  - 6. Starting System.
  - 7. Generator.
  - 8. Digital (microprocessor-based) electronic generator set controls, digital governor, and digital voltage regulator.
  - 9. Controls, Supervision and Distribution.
  - 10. Integration to/with day tank and main storage tank leak detection.
  - 11. Spare Parts.
  - 12. 150 KW rating, Synchronous alternator
  - 13. wired for 277/480 VAC 3 phase, 60HZ
  - 14. H-100 control panel-temp range -40 to 70 degrees C,
  - 15. Digital micro processor
  - 16. level 2 acoustic enclosure
  - 17. Battery with rack, heating pad, alternator, cables, tray
  - 18. Air cleaner
  - 19. Vibration isolators
  - 20. Block heater 1500W
  - 21. Crankcase heater, 200W



- 22. Remote emergency stop/flush
- 23. Ac/dc interior light
- 24. IBC seismic certified
- 25. EPA certified
- 26. Flex fuel lines for both LP and natural gas
- 27. Oil and radiator fluids and drain extensions
- 28. 5 year extended warrenty

E. This Engine-Generator set and associated equipment set shall be capable to operate with specification tolerances while powering only the ESS branch most lightly loaded, the life-safety branch.

## **1.2 RELATED WORK**

- A. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION: Requirements for hot piping and equipment insulation.
- B. Section 23 10 00, FACILITY FUEL SYSTEMS: Fuel supply and storage requirements. Coordinate integration of tanks level, etc monitoring and alarms.
- C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- E. Section 26 05 71, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY: Requirements for protective coordination of a standby and/or essential electrical system.
- M. Section 26 24 11, DISTRIBUTION SWITCHBOARDS: Requirements for secondary distribution switchboards.
- G. Section 26 36 23, AUTOMATIC TRANSFER SWITCHES: Requirements for automatic transfer switches for use with engine-generators.
- H. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS: Requirements to VAMC general commissioning.

## **1.3 QUALITY ASSURANCE**

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

## **1.4 QUALITY ASSURANCE**

- A. The supplier of the LP/NG-engine generator set shall be responsible for satisfactory total operation of the system and its certification. This supplier shall have had experience with three or more installations of systems of comparable size and complexity in regards to coordinating, engineering, testing and supervising. Each of these installations shall have been in successful operation for three or more years. Prior to review of submittals, the Government reserves the right to:
  - 1. Have the manufacturer submit a list of locations with similar installations.

2. Inspect any of these installations and question the user concerning the installations without the presence of the supplier.
- B. A factory-authorized representative shall be capable of providing emergency maintenance and repairs at the project site within 4 hours maximum of notification.
- D. Engine generator and auxiliary components shall be supplied from a single manufacturer.
- E. Noise level developed by the generator set shall be as herein specified.
- F. Factory Test: The Government shall have the option of witnessing the following tests at the factory. The tests shall be performed on the specific engine-generator(s) being manufactured for this project. The Government will pay all expenses for the Government representative's trip to witness these tests. The Contractor shall notify the COTR (4) four weeks prior to date of testing. The Manufacturer shall furnish load banks, testing instruments, and all other equipment necessary to perform these tests.
  1. Rated power factor of 0.8, "Reactant" factory test performed, documented, and certified while performing Load Test. The Power Factor testing shall be in accordance with NFPA 110 Code #7.13.4.3.2 and documented in accordance with NFPA 110 Code #7.13.4.6. See further details under EXECUTION herein.
  2. Load Test: Shall include six hours of continuous operation; four hours while the engine-generator is delivering 100% of the specified KW and two hours while delivering 110% of the specified KW. During this test record, the following data at 20-minute intervals:

Time	Engine RPM	Oil Temperature Out
KW	Water Temperature In	Fuel Pressure
Voltage	Water Temperature Out	Oil Pressure
Amperes	Oil Temperature In	Ambient Temperature

3. Quick Start Test: Record time required for the engine -generator to develop specified voltage, frequency, and KW load from a standstill condition.

## 1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, furnish the following:
- B. Shop Drawings:
  1. Sufficient information for this specific project's equipment, clearly presented, shall be included to determine compliance with drawings and specifications.
  2. Data shall be submitted in the following form:
    - a. Technical data sheets (TDS): These include published performance, rating and derating curves, published ratings, catalog cuts, pictures, manufacturer's specifications, material composition, and gauge thickness.

- b. Description of operation (DO): Manufacturer's literatures and, if suitable, diagrams.
- c. Calculations (CALC): Detailed engineering calculations with all equations, graphs, assumptions, and approximations shown, and data sources referenced.
- d. Certification (CERT): Written confirmation as to the document's accuracy, and genuineness.
- e. Shop Drawings (SD): Scaled drawings, showing plan views, side views, elevations, and cross - sections.

C. Diagrams:

Control system diagrams, elementary diagrams, control sequence diagrams or tables, wiring diagrams, interconnections diagrams (between local control, remote annunciator panels, remote monitoring panels, automatic transfer switches, paralleling switchgear, and fuel storage tank, as applicable), wireless connection diagrams, illustrative diagrams, flow diagrams, and other like items.

D. Technical Data:

1. Published ratings, catalog cuts, pictures, and manufacturers' specifications for engine-generator, governor, voltage regulator, radiator, muffler, dampers, day tank, pumps, AG fuel tank, batteries and charger, jacket heaters, torsional vibration, and control and supervisory equipment.
2. Description of operation.
3. Engine generator set: TDS, SD including sub-transient reactance and short-circuit current.
4. Sound power level data.
5. Other technical data to include details on:
  - a. Demonstrated information provided for the coordination study.
  - b. Engine jacket water heaters: TDS
  - c. Muffler assembly: TDS, SD
  - d. Day tank and pumps: TDS
  - e. Batteries, racks and charger: TDS, CALC
  - f. Torsional Vibration: CERT
  - g. Control and Supervisory Equipment: TDS, DGM, DO, SD
  - h. Performance:
    - 1) Voltage regulating equipment: TDS
    - 2) Frequency regulating equipment: TDS
    - 3) Voltage and frequency dips and recovery times due to specified motor loading: CALC
    - 4) Antifreeze derating: TDS
    - 5) Ambient De-Rating: TDS
  - i. Fuel oil system: LPM
  - j. Cooling system: LPM
  - k. Vibration isolators: TDS, CALC

- m. Vibration isolation system performance data from no-load to full-load (not less than 10 operating points).

E. Calculations:

Detailed engineering calculations with all equations, graphs, assumptions, and approximations shown and data sources referenced. Include any calculated performance de-rations appropriate to installed environment.

F. Manuals:

1. When submitting the shop drawings, submit complete maintenance and operating manuals of the engine generator and auxiliaries, including technical data sheets, wiring diagrams, and information, such as telephone number, fax number, and web sites, for ordering replacement parts.
2. Three (3) weeks prior to the final inspection, submit four copies of the updated maintenance and operating manual to the COTR:
  - a. Include complete "As installed" diagrams, which indicate all items of equipment and their interconnecting wiring.
  - b. Include complete diagrams of the internal wiring for each of the pieces of equipment, including "As installed" revisions of the diagrams.
  - c. The wiring diagrams shall identify the terminals to facilitate installation, maintenance, operation, and testing.
  - d. Include complete lists of spare parts and special tools recommended for two years of normal operation of the complete system.

G. Certifications:

1. Prior to fabrication of the engine-generator, submit the following to the COTR for approval:
  - a. A certification in writing that an engine-generator of the same model and configuration, with the same bore, stroke, number of cylinders, and equal or higher kW/kVA ratings as the proposed LP/NG engine-generator, has been operating satisfactorily with connected loads of not less than 75% of the specified KW/KVA rating, for not fewer than 2,000 hours without any failure of a crankshaft, camshaft, piston, valve, injector, or governor system.
  - b. A certification in writing that devices and circuits will be incorporated to protect the voltage regulator and other components of the engine-generator during operation at speeds other than the rated RPM while performing maintenance. Submit thorough descriptions of any precautions necessary to protect the voltage regulator and other components of the system during operation of the engine-generator at speeds other than the rated RPM.
  - c. A certification from the engine manufacturer stating that the engine exhaust emissions meet the federal, state, and local regulations and restrictions specified. At a minimum, this certification shall include emission factors for criteria pollutants including nitrogen oxides, carbon monoxide, particulate matter, sulfur dioxide, non-methane hydrocarbon, and hazardous air pollutants (HPAs).

2. Prior to installation of the engine-generator at the job site, submit four copies of certified factory test data to the COTR.
3. Three (3) weeks prior to the final inspection, submit four copies of the following to the COTR:
  - a. Certification by the engine-generator manufacturer that the equipment conforms to the requirements of the drawings and specifications.
  - b. A Certified report of field tests from the contractor that the engine-generator has been properly installed, adjusted, and tested.
  - c. A certificate by the manufacturer that the engine-generator, accessories, and components will withstand the design seismic event forces for use group II, design category A and site classification D and that the engine-generator will be fully operational after the design seismic event at the project site.

#### **1.6 STORAGE AND HANDLING**

- A. Equipment shall withstand shipping and handling stresses in addition to the electrical and mechanical stresses which occur during operation of the system. Protect radiator core with wood sheet.
- B. Store any equipment or materials in a location approved by the COTR.
- C. Storage on site will be extremely limited and should be carefully planned with general construction activities to fit in the limited space designated around the generator site location.

#### **1.7 JOB CONDITIONS**

- A. Shall conform to the arrangements and details shown on the drawings. The dimensions, enclosures, and arrangements of the engine-generator system shall permit the operating personnel to safely and conveniently operate and maintain the system in the space designated for installation.
- B. Unless specified otherwise, each component of the engine-generator system shall be capable of operating as specified herein at 1190 meters (3900 feet) above sea level in a ventilated room which will have average ambient air temperatures ranging from a minimum of minus 37.2 degrees C (minus 35 degrees F) in winter to maximum of 40 degrees C (104 degrees F) in summer. Average ambient temperature for de-rating shall be 85 F.
- C. The dimensions of equipment proposed by the contractor shall be coordinated to fit within the available working space generally outlined on the plans. Proposed equipment shall not encroach on working, service or code-required clearances. The contractor shall verify all clearances prior to ordering of any equipment.

#### **1.8 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):
  - C37.50-00.....Low-Voltage AC Power Circuit Breakers used In Enclosures-Test Procedures
  - C39.1-81 (R1992) .....Requirements for Electrical Analog Indicating Instruments
- C. American Society of Testing Materials (ASTM):

- A53/A53M-07 .....Standard Specification for Pipe, Steel, Black, and Hot-Dipped, Zinc Coated Welded and Seamless.
- B88-03 .....Specification for Seamless Copper Water Tube
- B88M-03 .....Specification for Seamless Copper water Tube (Metric)
- D975-09b .....Diesel Fuel Oils
- D. Institute of Electrical and Electronic Engineers (IEEE):
- C37.13-08 .....Low Voltage AC Power Circuit Breakers Used In Enclosures
- C37.90.1-02 .....Surge Withstand Capability (SWC) Tests for Relays and Relay Systems  
Associated with Electric Power Apparatus
- E. National Electrical Manufacturers Association (NEMA):
- ICS 6-06 .....Enclosures
- ICS 4-05 .....Terminal Blocks
- MG 1-07 .....Motor and Generators
- MG 2-01 ..... Safety Standard and Guide for Selection, Installation and use of Electric Motors  
and Generators
- PB 2-06 .....Dead Front Distribution Switchboards
- 250-08 .....Enclosures for Electrical Equipment (1000 Volts Maximum)
- F. National Fire Protection Association (NFPA):
- 30-08 .....Flammable and Combustible Liquids Code
- 37-06 .....Installations and Use of Stationary Combustion Engine and Gas  
Turbines
- 70-08 .....National Electrical Code (NEC)
- 99-05 .....Health Care Facilities
- 110-10 .....Standard for Emergency and Standby Power Systems
- G. Underwriters Laboratories, Inc. (UL):
- 50-95 .....Enclosures for Electrical Equipment
- 142-06 .....Steel Aboveground Tanks for Flammable and Combustible liquids
- 2085-97 .....Insulated Aboveground Tanks for Flammable and Combustible Liquids
- 2200-98 .....Stationery Engine Generator Assemblies
- 1236-06 .....Battery Chargers for Charging Engine-Starter Batteries
- 467-07 .....Grounding and Bonding Equipment
- 489-09 .....Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-  
Breaker Enclosures
- 508-99 .....Industrial Control Equipment
- 891-05 .....Switchboards

## PART 2 - PRODUCTS

### 2.1 GENERATOR SET

- A. The engine -generator system shall be in accordance with NFPA, UL, NEMA and ANSI, and as specified herein. All information required by these specifications shall shown on the drawings.
- B. Provide a factory-assembled, wired (except for field connections), complete, fully automatic liquid propane with conversion to natural gas engine-generator system.
- C. Engine-Generator Parameter Schedule:
  - Power Rating: Emergency Standby
  - Voltage: 277/480V
  - Power Factor: 0.8 lagging
  - Engine-Generator Application: stand-alone
  - Fuel: liquid propane with natural gas kit installed
  - Maximum Speed: 1800 RPM
  - Frequency Bandwidth (steady state): + 0.25 %
  - Voltage Regulation: + 1% (maximum) (No Load to Full Load) (standalone applications)
  - Voltage Bandwidth: + 1 % (steady state)
  - Frequency: 60 Hz
  - Phases: 3 Phase, Wye
  - Minimum Generator Sub transient Reactance: 8%
  - Maximum Generator Sub transient Reactance: 13%
  - Nonlinear Loads: 100 kVA
  - Max Step Load Increase: 75 % of service load at .8 PF
  - Transient Recovery Time with Step Load Increase (Voltage): 3 seconds
  - Transient Recovery Time with Step Load Increase (Frequency): 3 seconds
  - Maximum Frequency Deviation with 75% Step Load Increase: 30% of rated frequency
  - Max Step Load Decrease (without shutdown): 100% of service load at .8 PF
  - Max Time to Start and be Ready to Assume Load: 30 seconds
  - Max Summer Indoor Temp (Prior to Engine-Generator Operation): 104 degrees
  - Min Winter Indoor Temp (Prior to Engine-Generator Operation): 40 degrees
  - Max Summer Outdoor Temp (Ambient): 110 F°
  - Min Winter Outdoor Temp (Ambient): -40 C°
  - Installation Elevation: 4900 Ft above sea level
- D. Assemble, connect, and wire the equipment at the factory so that only the external connections need to be made at the construction site.
- E. Unit shall be factory -painted with manufacturer's primer and standard finishes.
- F. Connections between components of the system shall conform to the recommendations of the manufacturer of the LP/NG engine-generator set.

- G. Couplings, shafts, and other moving parts shall be enclosed and guarded. Guards shall be metal, ruggedly constructed, rigidly fastened, and readily removable for convenient servicing of the equipment without disassembling any pipes and fittings.
- H. Engine-generator shall have the following features:
  - 1. Factory-mounted on a common, rigid, welded, structural steel base.
  - 2. engine-generator shall be statically and dynamically balanced so that the maximum vibration in the horizontal, vertical, and axial directions shall be limited to 0.0059 in [0.15 mm], with an overall velocity limit of 0.866 in/sec [24 mm/sec] RMS, for all speeds.
  - 3. The isolators shall be constrained with restraints capable of withstanding static forces in any direction equal to twice the weight of the supported equipment.
  - 4. Shall be capable of operating satisfactorily as specified for not fewer than 10,000 hours between major overhauls.
- I. Engine-generator set shall be statically and dynamically balanced at the factory in order to comply with the maximum vibration velocity specified herein.

## **2.2 LUBRICATION OIL SYSTEM**

- A. Pressurized type.
- B. Positive-displacement pump driven by engine crankshaft.
- C. Full-flow strainer and full-flow or by-pass filters.
- D. Filters shall be cleanable or replaceable type and shall remove particles as small as 3 microns without removing the additives in the oil. For by-pass filters, flow shall be diverted without flow interruption.
- E. Extend lube oil sump drain line out through the skid base and terminate it with a drain valve and plug.
- F. If shown connected on plans, provide a 120-volt oil heater for exterior engine-generator.

## **2.3 FUEL SYSTEM**

- A. Main fuel storage tank(s) shall leased by the VA but will be installed and connection made by this contract.
- B. Shall comply with NFPA 37 and NFPA 30, and have the following features:
  - 1. Vaporizers.
  - 2. Filters or screens that require periodic cleaning or replacement shall not be permitted in the injection system assemblies.
- C. Piping System: Black steel standard weight ASTM A-53 pipe and necessary valves and pressure gauges between:
  - 1. Connections at the engine shall be made with flexible piping suitable for the fuel furnished.
  - 2. See fuel oil piping diagram on the drawings.
- D. The unit shall be equipped with a totalizing fuel use meter with features and accuracy as required by Wyoming Department of Environmental Quality.

## **2.6 COOLING SYSTEM**

- A. Liquid cooled, closed loop, with fin-tube radiator mounted on the engine -generator, and integral engine driven circulating pump, as shown on the drawings.



- B. Cooling capacity shall not be less than the cooling requirements of the engine-generator and its lubricating oil while operating continuously at 110% of its specified rating.
- C. Coolant shall be extended life antifreeze solution, 50% ethylene glycol and 50% soft water, with corrosion inhibitor additive as recommended by the manufacturer.
- E. Fan shall be driven by multiple belts from engine shaft.
- F. Coolant hoses shall be flexible, per manufacturer's recommendation.
- G. Self-contained thermostatic-control valve shall modulate coolant flow to maintain optimum constant coolant temperature, as recommended by the engine manufacturer.
- H. Motor-Operated Dampers:
  - 1. Dampers, which are provided under Section 23 31 00, HVAC DUCTS AND CASINGS, shall be two-position, electric motor-operated, fail open.
  - 2. Dampers shall open on warm ambient temperature or simultaneously with the starting of the LP/NG engine and shall close simultaneously with the stopping of the engine.

## **2.7 AIR INTAKE AND EXHAUST SYSTEMS**

- A. Air Intake:
  - Provide an engine-mounted air cleaner with replaceable dry filter and dirty filter indicator.
- B. Exhaust System:
  - 1. Install per manufactures requirements.
- C. Condensate drain at muffler shall be made with schedule 40 black steel pipe through a petcock.
- D. Exhaust Piping and Supports: Black steel pipe, ASTM A-53 standard weight with welded fittings, supported by spring-type hangers.
- E. Vertical exhaust piping shall be provided with a hinged, gravity-operated, self-closing rain cover.

## **2.8 ENGINE STARTING SYSTEM**

- A. Shall start the engine at any position of the flywheel.
- B. Electric cranking motor:
  - 1. Shall be engine mounted.
  - 2. Shall crank the engine via a gear drive.
  - 3. Rating shall be adequate for cranking the cold engine at the voltage provided by the battery system, and at the required RPM during five consecutive starting attempts of 30 seconds cranking each at 30-second intervals, for a total of 50 seconds of actual cranking without damage (the fifth starting attempt will be manually initiated upon failure of a complete engine cranking cycle).
- C. Batteries shall be lead-acid high discharge rate type.
  - 1. Each battery cell shall have minimum and maximum electrolyte level indicators and a flip-top flame arrestor vent cap.
  - 2. Batteries shall have connector covers for protection against external short circuits.
  - 3. With the charger disconnected, the batteries shall have sufficient capacity so that the total system voltage does not fall below 85% of the nominal system voltage with the following demands:

- a. Five consecutive starting attempts of 10 seconds cranking at 10second intervals for a total of 50 seconds of actual cranking (the fifth starting attempt will be manually initiated upon failure of a complete engine cranking cycle).
- 4. Battery racks shall be metal with an alkali -resistant finish and thermal insulation, and secured to the floor.
- D. Battery Charger:
  - 1. A current-limiting battery charger, conforming to UL 1236, shall be provided and shall automatically recharge the batteries. The charger shall be capable of an equalize-charging rate for recharging fully depleted batteries within 24 hours and a floating charge rate for maintaining the batteries at fully charged condition.
  - 2. An ammeter shall be provided to indicate charging rate. A voltmeter shall be provided to indicate charging voltage.

## **2.9 LUBRICATING OIL HEATERS**

If called out or connected on plans, provide a thermostatically-controlled electric heater to automatically maintain the oil temperature within plus or minus 3° F [1.7° C] of the control temperature.

## **2.10 JACKET COOLANT HEATERS**

Provide a thermostatically-controlled electric heater mounted in the engine coolant jacketing to automatically maintain the coolant within plus or minus 3° F [1.7° C] of the temperature recommended by the engine manufacturer to meet the starting time specified at the minimum winter outdoor temperature.

## **2.11 GENERATOR**

- A. Synchronous, amortisseur windings, bracket-bearing, self-venting, rotating-field type connected directly to the engine.
- B. Lifting lugs designed for convenient connection to and removal from the engine.
- C. Integral poles and spider, or individual poles dove-tailed to the spider.
- D. Insulation shall be as required for the ambient temperature and other requirements.
- E. All insulation system components shall meet NEMA MG1 requirements for class H insulation systems.
- F. Designed for sustained short -circuit currents in conformance with NEMA Standards.
- G. Designed for sustained operation at 125% of the RPM specified for the engine-generator without damage.
- H. Telephone influence factor shall conform to NEMA Standards.
- I. Furnished with brushless excitation system or static-exciter-regulator assembly.
- J. Nameplates attached to the generator and exciter shall show the manufacturer's name, equipment identification, serial number, voltage ratings, field current ratings, KW/KVA output ratings, power factor rating, time rating, temperature rise ratings, RPM ratings, full load current rating, number of phases and frequency, and date of manufacture.
- K. The grounded (neutral) conductor shall be electrically isolated from equipment ground and terminated in the same junction box as the phase conductors.

L. Display alarms and status of the system to include all require by NFPA 110 on the remote annunciator.

## 2.12 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator circuit breakers shall be molded-case, electronic-trip type, and 100% rated, complying with UL 489. Tripping characteristics shall be adjustable long-time and short-time delay and instantaneous. Provide shunt trip-to-trip breaker when engine-generator is shut down by other protective devices, like the emergency stop button.

## 2.13 CONTROLS

- A. Shall include Local Engine Generator Control and status displays and a Remote Annunciator Panel.
- B. General:
1. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and protection and control functions for the generator set, located on the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring as described in this specification.
  2. Coordinate controls with the automatic transfer devices shown on the drawings, so that the systems will operate as specified and as required per NFPA 110 and the VA requirements.
  3. Control Equipment shall be in accordance with UL 508, NEMA ICS-4, ICS-6, and ANSI C37.90.1.
  4. Panels shall be in accordance with UL 50.
  5. Wiring: Insulated, rated at 600 V.
    - a. Install the wiring in vertical and horizontal runs, neatly harnessed.
    - b. Terminate all external wiring at heavy duty, pressure -type, terminal blocks.
  6. Clearly and permanently label the equipment, wiring terminals, and wires shall be clearly and permanently labeled.
  7. The appropriate wiring diagrams shall be laminated or mounted under plexiglass within the frame on the inside of the cubicles and panels.
  8. All indicating lamps and switches shall be accessible and mounted on the cubicle doors.

Voltage Monitors	+ 2 percent of set point
Current Monitors	+ 3 percent of set point
Frequency Monitors	+ 0.2 Hz.
Power Monitors	+ 3 percent of set point

10. The manufacturer shall coordinate the interfacing of the control systems with all related equipment supplied in accordance with other sections of the project specification.

C. Engine-Generator Controls:

1. Starting and Stopping Controls:

- a. A three-position, maintained-contact type selector switch with positions marked "AUTOMATIC," "OFF," and "MANUAL." Provide flashing amber light for OFF and MANUAL positions.
  - b. A momentary contact push-button switch with positions marked "MANUAL START" and "MANUAL STOP."
  - c. Selector switch in AUTOMATIC position shall cause the engine to start automatically when a single pole contact in a remote device closes. When the generator's output voltage increases to not less than 90% of its rated voltage, and its frequency increases to not less than 58 Hz, the remote devices shall transfer the load to the generator. An adjustable time delay relay, in the 0 to 15 minute range, shall cause the engine-generator to continue operating without any load after completion of the period of operation with load. Upon completion of the additional 0 to 15 minute (adjustable) period, the engine-generator shall stop.
  - d. Selector switch in OFF position shall prevent the engine from starting either automatically or manually. Selector switch in MANUAL position shall also cause the engine to start when the manual start push-button is depressed momentarily.
  - e. With selector switch is in MANUAL position, depressing the MANUAL STOP push-button momentarily shall stop the engine after a cool-down period.
  - f. A maintained-contact, red mushroom-head push-button switch marked "EMERGENCY STOP" will cause the engine to stop without a cool down period, independent of the position of the selector switch.
2. Engine Cranking Controls:
- a. The cranking cycles shall be controlled by a timer that will be independent of the battery voltage fluctuations.
  - b. The controls shall crank the engine through one complete cranking cycle, consisting of four starting attempts of 10 seconds each and 10 seconds between each attempt.
  - c. Total actual cranking time for the complete cranking cycle shall be 40 seconds during a 70-second interval.
  - d. Cranking shall terminate when the engine starts so that the starting system will not be damaged. Termination of the cranking shall be controlled by self-contained, speed-sensitive switch. The switch shall prevent re-cranking of the engine until after the engine stops.
  - e. After the engine has stopped, the cranking control shall reset.
3. Supervisory Controls:
- a. Overcrank:
    - 1) When the cranking control system completes one cranking cycle (four starting attempts), without starting the engine, the OVERCRANK signal light and the audible alarm shall be energized.
    - 2) The cranking control system shall lock-out, and shall require a manual reset.
  - b. Coolant Temperature:

- 1) When the temperature rises to the predetermined first stage level, the HIGH COOLANT TEMPERATURE - FIRST STAGE signal light and the audible alarm shall be energized.
  - 2) When the temperature rises to the predetermined second stage level, which shall be low enough to prevent any damage to the engine and high enough to avoid unnecessary engine shutdowns, the HIGH COOLANT TEMPERATURE - SECOND STAGE signal light and the audible alarm shall be energized and the engine shall stop.
  - 3) The difference between the first and second stage temperature settings shall be approximately 10° F [-12° C].
  - 4) Permanently indicate the temperature settings near the associated signal light.
  - 5) When the coolant temperature drops to below 70° F [21° C], the "LOW COOLANT TEMPERATURE" signal light and the audible alarm shall be energized.
- c. Low Coolant Level: When the coolant level falls below the minimum level recommended by the manufacturer, the LOW COOLANT LEVEL signal light and audible alarm shall be energized.
- d. Lubricating Oil Pressure:
- 1) When the pressure falls to the predetermined first stage level, the OIL PRESSURE - FIRST STAGE signal light and the audible alarm shall be energized.
  - 2) When the pressure falls to the predetermined second stage level, which shall be high enough to prevent damage to the engine and low enough to avoid unnecessary engine shutdowns, the OIL PRESSURE - SECOND STAGE signal light and the audible alarm shall be energized and the engine shall stop.
  - 3) The difference between the first and second stage pressure settings shall be approximately 15% of the oil pressure.
  - 4) The pressure settings near the associated signal light shall be permanently displayed so that the running oil pressure can be compared to the target (set point) value.
- e. Over speed:
- 1) When the engine RPM exceeds the maximum RPM recommended by the manufacturer of the engine, the engine shall stop.
  - 2) Simultaneously, the OVERSPEED signal light and the audible alarm shall be energized.
- f. Low Fuel - Day Tank:
- When the fuel oil level in the day tank decreases to less than the level at which the fuel oil transfer pump should start to refill the tank, the LOW FUEL DAY TANK light and the audible alarm shall be energized.
- g. Low Fuel – Main Storage Tank:
- When the fuel oil level in the storage tank decreases to less than one-third of total tank capacity, the LOW FUEL-MAIN STORAGE TANK signal light and audible alarm shall be energized.

- h. Reset Alarms and Signals: Overcrank, Coolant Temperature, Coolant Level, Oil Pressure, Over speed, and Low Fuel signal lights and the associated audible alarms shall require manual reset. A momentary-contact silencing switch and push-button shall silence the audible alarm by using relays of solid state devices to seal in the audible alarm in the de-energized condition. Elimination of the alarm condition shall automatically release the sealed in circuit for the audible so that it will be automatically energized again when the next alarm condition occurs. The signal lights shall require manual reset after elimination of the condition which caused them to be energized. Install the audible alarm just outside the generator room in a location as directed by the COTR. The audible alarm shall be rated for 85 dB at 10 ft [3 M].
- i. Generator Breaker Signal Light:
  - 1) A flashing green light shall be energized when the generator circuit breaker is in the OPEN or TRIPPED position.
  - 2) Simultaneously, the audible alarm shall be energized.
- 4. Monitoring Devices:
  - a. Electric type gauges for the cooling water temperatures and lubricating oil pressures. These gauges may be engine mounted with proper vibration isolation.
  - b. A running time indicator, totalizing not fewer than 9,999 hours, and an electric type tachometer.
  - c. A Voltmeter, ammeter, frequency meter, kilowatt meter, manual adjusting knob for the output voltage, and the other items shown on the drawings shall be mounted on the front of the generator control panels.
  - d. Install potential and current transformers as required.
  - e. Individual signal lights:
    - 1) OVER-CRANK
    - 2) HIGH COOLANT TEMPERATURE - FIRST STAGE
    - 3) HIGH COOLANT TEMPERATURE - SECOND STAGE
    - 4) LOW COOLANT TEMPERATURE
    - 5) OIL PRESSURE - FIRST STAGE
    - 6) OIL PRESSURE - SECOND STAGE
    - 7) LOW COOLANT LEVEL
    - 8) GENERATOR BREAKER
    - 9) OVERSPEED
    - 10) LOW FUEL - DAY TANK
    - 11) LOW FUEL – MAIN STORAGE TANK
  - f. Lamp Test: The LAMP TEST momentary contact switch shall momentarily actuate the alarm buzzer and all the indicating lamps.
- 5. Automatic Voltage Regulator:

- a. Shall correct voltage fluctuations rapidly and restore the output voltage to the predetermined level with a minimum amount of hunting.
- b. Shall include voltage level rheostat located inside the control cubicle.
- c. Provide a 3-phase automatic voltage regulator immune to waveform distortion.

6. Network connection Module:

- a. The generator set shall be provided with a network communication module to allow real time communication with the generator set by remote devices. The control shall communicate all engine and alternator data; alarm, shutdown and status conditions of the generator set via the network in both test and emergency modes. Include network wiring to the adjacent WTP facility, transient surge suppression modules at each end, and Ethernet gateway to owner LAN.
- D. If required by the selected alternator, provide a output control contact from the Generator controller to allow shunt trip of the EQ HVAC branch breaker in 7-GDP. The basis of the output shall be to prevent overload of the entire generator due to potential starts both chillers at the same time. The output time and overload % setpoints shall be adjustable, but generally based on a generator overload/warning condition for a set amount of time. The setpoints shall be coordinated with the main breaker settings on the genset and 7-GDP to prevent loss of the entire system.

## **2.14 GENSET LOCAL STATUS LIGHTS AND HORN**

- A. Provide Exterior-mounted status lights & horn with latch-in:
  - 1. Generator “alarm/shutdown”-red, with signage.
  - 2. Generator “fuel alarm”-red, with signage.
  - 3. Generator “ready”-white, with signage.
  - 4. Generator “alarm” horn, with signage.
- B. Status lights:
  - 1. Lights shall be a minimum of 4” diameter, LED-type, weather rated.
  - 2. Installation shall be weatherproof.
- C. Status horn shall be surface or recess, unit-mounted with the status lights.
  - 1. The horn shall be a minimum of 3 watts, weather-rated.
- D. HOA Switch: Hand position shall test the lamps and horn, Off mode shall reset the alarm condition (and also indicate “LOCAL ALARM HOA Derangement” via genset annunciator), and auto position shall place the latching circuit in a ready mode. The switch shall be installed accessible from exterior grade.
- E. Mounting and Finish:
  - 1. Horns and lights shall be mounted adjacent to each other, shall be surface or recess(if possible) mounted, and weather rated for the environment.
  - 2. The lights and horn shall be finished in the same manner/color as the generator building-painted to match brick structure as acceptable to the VAMC.

## **2.15 REMOTE ANNUNCIATOR PANEL**

- A. A Remote annunciator panel shall be installed in the electrical room location as shown on the drawings.

- B. The annunciator shall indicate alarm conditions of the engine-generator as follows:
  - 1. Individual visual signals shall indicate generator run.
  - 2. Individual visual signals plus a common audible alarm shall warn of the following:
    - a. LOW LUBRICATING OIL PRESSURE
    - b. LOW COOLANT
    - c. HIGH COOLANT TEMPERATURE
    - d. LOW FUEL - DAY TANK
    - e. LOW FUEL – MAIN TANK
    - f. FAILURE TO START
    - g. OVERSPEED
- C. The annunciator shall also have the following features:
  - 1. Lamp test momentary contact switch which will momentarily actuate the alarm buzzer and all indicating lamps.
  - 2. Audible Alarm: There shall be an audible alarm, rated for 85 dB at 10 feet, which shall become actuated whenever an alarm condition occurs. A momentary contact ‘acknowledge push-button’ shall silence the audible alarm, but not clear the alarm lamp. Elimination of the alarm condition shall automatically release the seal in circuit for the audible alarm and extinguish the alarm lamp.
- D. Include control wiring between the remote annunciator panel and the engine-generator. Wiring shall be as required by the manufacturer, listed for underground installations.
- E. Custom Indications: Provisions shall be made for indication of four customer specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above specified conditions. The non automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.
- F. Provide programming, control wiring and isolated dry contact to the Gen Ann Panel location to facilitate monitoring of an “WTP Generator Abnormal Fuel Condition” system Trouble (including, but not limited to, Low Fuel Warning, High Fuel Warning, or Leak Detected) signals from the Fuel Leak Detection System. This contact will be monitored by the Fire Alarm system.

## **2.16 CONNECTION CABINETS**

- A. Provide power system connection cabinets for “Temporary Generator” and for “Load Bank Testing” power and/or controls connections. Cabinets shall be in a NEMA 1 cabinet, of not less than 14ga steel and rated 208/120Y, of minimum ampacity indicated on plans with minimum SCCR as require by the Generator system installed.
- B. Cabinets are to be wall-mounted if possible and must fit within the available spaces as delineated on plans. If floor mounted, provide a housekeeping pad.



- C. Supplier shall coordinate the connections top or bottom with space and balance of gear. Future connections shall be made through-the-wall as generally indicated on plans.
- D. Cabinets shall be labeled with operational procedures.
- E. Cabinets shall have safety interlocks and shields to minimize potential for accidental shock.
- F. Provide provision at the power cabling portals on plan to maintain weather resistance.

## **2.17 SPARE PARTS**

- A. For each engine generator:
  - 1. Six lubricating oil filters.
  - 2. Six primary fuel oil filters.
  - 3. Six secondary fuel oil filters.
  - 4. Six intake air filters.
- B. For each battery charger:
  - Three complete sets of fuses.
- C. For each control panel:
  - Three complete sets of fuses.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install a concrete "housekeeping" base minimum of 3-1/2" tall for the engine generator. The concrete base shall generally be a minimum of the same weight as the engine-generator set, base, tank, and fuel. The base shall extend a minimum of 6 inches beyond the edge of the equipment. See structural plans for additional information.
- B. Installation of the engine -generator shall comply with manufacturer's written instructions and with NFPA 110.
- C. Mounting:
  - 1. Support the base of engine generator on vibration isolators, each isolator bolted to the floor (pad), and the generator base bolted to isolator.
  - 2. Install sufficient isolators so that the floor (pad) bearing pressure under each isolator is within the floor (pad) loading specification.
  - 3. Install equal number of isolators on each side of the engine generator's base.
  - 4. Locate isolators for approximately equal load distribution and deflection per isolator. The Base of the engine-generator shall be drilled at the factory for the isolator bolts.
  - 5. Isolators shall be shipped loose with the engine-generator.
  - 6. All connections between the engine-generator and exterior systems, such as fuel lines, electrical connections, and engine exhaust system and air exhaust shroud, shall be flexible.
- D. Balance:

1. The vibration velocity in the horizontal, vertical, and axial directions shall not exceed 0.65 in [16.25 mm] per second peak at any specific frequency. These limits apply to main structural components such as the engine block and the generator frame at the bearings.
  2. Balance the engine generator set statically and dynamically at the factory in order to comply with the maximum specified vibration velocity.
- E. Connect all components of the generator system so that they will continue to be energized during failure of the normal electrical power supply system.
- F. Install piping between LP/NG engine-generator and remote components of cooling, fuel, and exhaust systems.
- G. Flexible connection between radiator and exhaust shroud at the wall damper:
1. Install noncombustible flexible connections made of 20-oz neoprene coated fiberglass fabric approximately 6 in [150 mm] wide.
  2. Crimp and fasten the fabric to the sheet metal with screws 2 in [50 mm] on center. The fabric shall not be stressed, except by the air pressure.
- H. Exhaust System Insulation:
1. Adhesive and insulation materials shall be applied on clean, dry surfaces from which loose scale and construction debris has been removed by wire brushing.
  2. Fill all cracks, voids, and joints of applied insulation material with high temperature 2000° F [1093° C] insulating cement before applying the outer covering.
  3. The installation shall be clean and free of debris, thermally and structurally tight without sag, neatly finished at all hangers or other penetrations, and shall provide a smooth finish surface.
  4. Insulation and jacket shall terminate hard and tight at all anchor points.
  5. Insulate completely from engine exhaust flexible connection through roof or wall construction, including muffler.
  6. Comply with Division 23 Insulation Specifications.
  7. Coordinate the Supply and installation of the roof thimble with Division 23 and the designed structure.

### **3.2 ACCEPTANCE CHECKS AND TESTS/COMMISSIONING**

- A. Provide the services of a factory-authorized, factory trained representative of the LP/NG engine-generator manufacturer to inspect field-assembled components, and equipment installation and supervise the field tests.
- B. When the complete engine-generator system has been installed and prior to the final inspection, test all components of the system in the presence of the Commissioning Agent and COTR for proper operation of the individual components and the complete system and to eliminate electrical and mechanical defects.
- C. Furnish fuel oil, lubricating oil, anti-freeze liquid, water treatment, and rust-inhibitor and load bank for testing of the engine-generator.
- D. Visual Inspection: Visually verify proper installation set.

E. Set relays per this specification. Set engine-generator circuit breaker protective functions per Section 26 05 71, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY.

F. Field Tests for the Engine-Generator Set shall fulfill the commissioning requirements of NFPA 110 and the VA requirements. The testing shall include, but not be limited to the following:

1. Perform manufacturer's after-starting checks and inspections.
2. Test the engine-generator for eight hours of continuous operation as follows:
  - a. First six hours while the engine-generator is delivering 100% of its specified KW rating.
  - b. Last two hours while the engine-generator is delivering 110% of its specified KW rating.
  - c. If during the 8-hour continuous test, a failure occurs, either the engine shuts down or the full KW rating of the load bank is not achieved, the test is null and void. The test(s) shall be repeated at no additional cost to the government until satisfactory results are attained. Any additional fuel cost due to testing failures shall be the responsibility of the manufacturer.
3. Record the following test data at 30-minute intervals:
  - a. Time of day, as well as reading of running time indicator.
  - b. KW.
  - c. Voltage on each phase.
  - d. Amperes on each phase.
  - e. Engine RPM.
  - f. Frequency.
  - g. Engine water temperature.
  - h. Fuel pressure.
  - i. Oil pressure.
  - j. Outdoor temperature.
  - k. Average ambient temperature in the vicinity of the engine-.
  - l. Average ambient temperature in the vicinity of the starting batteries.
4. Demonstrate that the engine-generator will attain proper voltage, frequency, and will accept the specified block load within the specified time limit from a cold start after the closing of a single contact.
5. Furnish a resistance-type load for the testing of the engine-generator. Test loads shall always include adequate resistance to assure stability of the loads and equipment during all of the testing operations. The test load kW rating shall not be less than 110% of the specified kW rating of the engine-generator.

E. Factory Tests:

1. Test the engine generator by performing a Factory Inductive Load Test and provide Certified Factory Test reports to demonstrate compliance with NFPA 110 for load and the application of this Engine-Generator Set. Testing shall include, but not be limited to, the following:
  - a. First six hours while the set is delivering 100 percent of its specified KW rating *while at a 0.8 power factor*.

- b. Last two hours while the set is delivering 110 percent of its specified KW rating *while at a 0.8 power factor*.
  - c. If during the 8-hour continuous test a failure occurs, either the engine shuts down or the full KW rating of the load bank is not achieved, the test is null and void. The test(s) shall be repeated until the satisfactory results are attained at no additional cost to the government.
- 2. Record the following test data at 30-minute intervals:
  - a. Time of day, also reading of running time indicator.
  - b. KW.
  - c. Voltage on each phase.
  - d. Amperes on each phase.
  - e. Engine RPM.
  - f. Frequency.
  - g. Engine water temperature.
  - h. Fuel pressure
  - i. Oil pressure.
  - j. Outdoor temperature
  - k. Average ambient temperature in the vicinity of the engine.
  - l. Average ambient temperature in the vicinity of the starting batteries.
- G. Starting System Test:
  - 1. Demonstrate that the batteries and cranking motor are capable of five starting attempts of 10 seconds cranking each at 10 -second intervals with the battery charger turned off.
- H. Remote Annunciator Panel Tests:
 

Simulate conditions to verify proper operation of each indicating lamp, alarm device, meter, interconnecting hardware and software, and reset button.
- I. Fuel systems shall be flushed and tested per Section 23 10 00, FACILITY FUEL SYSTEMS: Fuel supply and storage requirements.
- J. Automatic Operation Tests:
 

Test the engine-generator to demonstrate automatic starting, loading and unloading. The load for this test shall utilize both load banks and actual loads to be served. Initiate loss of normal source and verify the specified sequence of operation. Restore the normal power source and verify the specified sequence of operation. Verify resetting of controls to normal.
- L. At the completion of the field tests, fill the storage tank with fuel of grade and quality as recommended by the manufacturer of the engine. Fill all engine fluids to levels as recommended by manufacturer.
- M. When any defects are detected during the tests, correct all the deficiencies and repeat all or part of the 8-hour continuous test as requested by the COTR, at no additional cost to the Government.
- N. See Electrical Commissioning for additional requirements and the authority/role of the third party commissioning agent.

- L. Provide test and inspection results in writing to the Commissioning Agent and COTR.

### **3.3 FOLLOW-UP VERIFICATION**

Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the engine-generator(s) and control and annunciation components are in good operating condition and properly performing the intended function.

### **3.4 INSTRUCTIONS AND FINAL INSPECTIONS**

- A. Laminate or mount under Plexiglas a set of operating instructions for the system and install instructions within a frame mounted on the wall near the engine-generator set as requested by the COTR.
- B. At the final inspection in the presence of the Commissioning Agent and COTR, demonstrate that the complete auxiliary electrical power system operates properly in every respect.
- C. Furnish the services of a competent, factory-trained engineer or technician for three, 4-hour periods for instructions to VA personnel in operation and maintenance of the equipment, on the dates requested by the COTR.

--- E N D ---

## **SECTION 26 36 23 AUTOMATIC TRANSFER SWITCHES**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

This section specifies the furnishing, complete installation, connection, and functional testing of open-transition automatic transfer switches with bypass isolation. Units shall be manufactured by ASCO or a pre-approved equal.

#### **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 in Division 26.
- B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and Wiring.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personal safety and to provide a low impedance path for possible ground fault currents.
- D. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Raceways for power and control wiring.
- E. Section 26 05 71, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY: Requirements for a coordinated electrical system.
- F. Section 26 32 13, ENGINE-GENERATORS: Requirements for normal and emergency power generation.

#### **1.3 QUALITY ASSURANCE**

##### **A. QUALITY ASSURANCE**

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

- B. A factory-authorized representative shall maintain a service center capable of providing emergency maintenance and repair services at the project site within 4 hour maximum response time.
- B. Automatic transfer switch, bypass/isolation switch and annunciation control panels shall be products of same manufacturer.
- C. Comply with OSHA – 29 CFR 1910.7 for the qualifications of the testing agency.

#### **1.4 FACTORY TESTS**

- A. Automatic transfer switches shall be thoroughly tested at the factory to ensure that there are no electrical or mechanical defects. Tests shall be conducted per UL standards. Factory tests shall be certified. The following factory tests shall be performed:
  - 1. Visual inspection to verify that each ATS is as specified.
  - 2. Mechanical test to verify that ATS sections are free of mechanical hindrances.
  - 3. Insulation resistance test to ensure integrity and continuity of entire system.
  - 4. Main switch contact resistance test.

5. Electrical tests to verify complete system electrical operation and to set up time delays and voltage sensing settings.

## 1.5 SUBMITTALS

- A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, furnish the following:
- B. Shop Drawings:
  1. Clearly present sufficient information to determine compliance with drawings and specifications.
  2. Include electrical ratings (including withstand), dimensions, weights, mounting details, conduit entry provisions front view, side view, equipment and device arrangement, elementary and interconnection wiring diagrams, and accessories.
  3. Complete nameplate data, including manufacturer's name and catalog number.
  4. A copy of the markings that are to appear on the transfer switches when installed.
- C. Manuals:
  1. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating and maintenance manuals, including technical data sheets, wiring diagrams and information, such as telephone number, fax number and web sites, for ordering replacement parts.
  2. Three (3) weeks prior to final inspection, submit four copies of a final updated maintenance and operating manual to the COTR.
    - a. Include complete "As installed" diagrams that indicate all pieces of equipment and their interconnecting wiring.
    - b. Include complete diagrams of the internal wiring for each piece of equipment, including "As installed" revisions of the diagrams.
    - c. The wiring diagrams shall identify the terminals to facilitate installation, maintenance, operation, and testing.
- D. Certifications:
  1. Submit, simultaneously with the shop drawings, a certified test report from a recognized independent testing laboratory that a representative sample has passed UL 1008 Prototype testing.
  2. Three (3) weeks prior to final inspection, submit four copies of the following to the COTR:
    - a. Certification that no design changes have been made to the switch or its components since last certified by UL or tested by an independent laboratory.
    - b. Certification by the manufacturer that the equipment conforms to the requirements of the drawings and specifications.
    - c. Certification that the 'withstand current' rating has been coordinated with upstream protective devices.
    - d. Certification by the Contractor that the equipment has been properly installed, adjusted, and tested.
    - d. A certified test report from an independent laboratory that a representative sample has passed the ANSI surges withstand test for transfer switches which incorporate solid-state components.

## 1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only:
- B. Institute of Electrical and Electronic Engineers (IEEE):
- 446-95 .....Recommended Practice for Design and Maintenance of Emergency and Standby Power Systems
  - C37.90.1-02.....Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
  - C62.41.1-02.....Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
  - C62.41.2 .....Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
- C. National Electrical Manufacturers Association (NEMA):
- 250-03 .....Enclosure for Electrical Equipment (1000 Volts Maximum)
  - ICS 6-06 .....Enclosures
  - IC3 4-05 .....Industrial Control and Systems: Terminal Blocks
  - MG 1-07 .....Motors and Generators
- D. National Fire Protection Association (NFPA):
- 70-08.....National Electrical Code (NEC)
  - 99-05 .....Health Care Facilities
  - 110-10 .....Emergency and Standby Power Systems
- E. Underwriters Laboratories, Inc. (UL):
- 50-95 .....Enclosures for Electrical Equipment
  - 508-99 .....Industrial Control Equipment
  - 891-05 .....Dead-Front Switchboards
  - 1008-96 .....Transfer Switch Equipment

## PART 2 - PRODUCTS

### 2.1 OPEN-TRANSITION AUTOMATIC TRANSFER SWITCH

- A. General:
1. Comply with UL, NEMA, NEC, ANSI, IEEE, and NFPA.
  2. Automatic transfer switches are to be 4-pole, electrically operated, 'mechanically held' open contact type, without integral overcurrent protection. Automatic Transfer switches utilizing automatic or non-automatic molded case circuit breakers, insulated case circuit breakers, or power circuit breakers as switching mechanisms are not acceptable.
  3. Automatic transfer switches shall be completely factory-assembled and wired such that only external circuit connections are required in the field. The unit shall include, but not be limited to, operating



mechanism, main contacts, auxiliary contacts, timers, pilot lights, switches, and auxiliary sensing devices.

4. Each automatic transfer switch shall be equipped with an integral bypass/ isolation switch.
5. Ratings:
  - a. Phases, voltage, ampere rating, poles, and withstand current rating, 3-Phase, 208/120V, 4-pole.  
Ampere ratings shall equal the feeder ratings to/from the transfer switch. Withstand ratings shall be as shown on the drawings. The ampere rating shall be for 100 percent continuous load current.
  - b. Transfer switches are to be rated for continuous duty at specified continuous current rating on 60Hz systems.
  - c. Ratings shall be with non-welding of contacts during the performance of withstand and closing tests.
  - d. Maximum automatic transfer switch rating: 800 A.
6. Markings:
  - a. Markings shall be in accordance with UL 1008.
  - b. Markings for the additional withstand test specified below shall be included in the nameplate data.
7. Tests:

Automatic Transfer switches shall be tested in accordance with UL 1008. The contacts of the transfer switch shall not weld during the performance of withstand and closing tests when used with the upstream overcurrent device and available fault current specified.

- b. The available short -circuit current at the transfer switch locations are shown on the drawings but shall not be less than the following.

Switch Rating (Amperes)	Withstanding Amperes (RMS Symmetrical)	Circuit Power Factor
Up to 800	22,000	Per UL

8. Surge Withstand Test:

Transfer switches utilizing solid-state devices in sensing, relaying, operating, or communication equipment or circuits shall comply with IEEE C37.90.1.

9. Housing:

- a. Enclose automatic transfer switches in wall -mounted steel cabinets, with metal gauge not less than No. 14, in accordance with UL 508, or in a switchboard assembly in accordance with UL 891, as shown on the drawings. NEMA Type 1 unless otherwise indicated on the drawings.
- b. Enclosure shall be constructed so that personnel are protected from energized bypass-isolation components during automatic transfer switch maintenance.
- c. Automatic transfer switch components shall be removable without disconnecting external source or load power conductors.

- d. Doors: Shall have three-point latching mechanism. Provide padlocking provisions and chain for attaching a padlock. Attach chain to the cabinet by welding or riveting.
  - e. Finish: Cabinets shall be given a phosphate treatment, painted with rust -inhibiting primer, and finish -painted with the manufacturer's standard enamel or lacquer finish.
  - e. Viewing Ports: Provide viewing ports so that contacts may be inspected without disassembly.
- B. Automatic Transfer switches shall include the following features:
- 1. Operating Mechanism:
    - a. Actuated by an electrical operator.
    - b. Electrically and mechanically interlocked so that the main contact cannot be closed simultaneously in both normal and emergency positions.
    - c. Normal and emergency main contacts shall be mechanically locked in position by the operating linkage upon completion of transfer. Release of the locking mechanism shall be possible only by normal operating action.
    - d. Contact transfer time shall not exceed six cycles.
    - e. Operating mechanism Components and mechanical interlocks shall be insulated or grounded.
  - 2. Contacts:
    - a. Main contacts: Silver alloy.
    - b. Neutral contacts: Silver alloy, with same current rating as phase contacts.
    - c. Current carrying capacity of arcing contacts shall not be used in the determination of the automatic transfer switch rating, and shall be separate from the main contacts.
    - d. Main and arcing contacts shall be visible for inspection with cabinet door open and barrier covers removed.
  - 3. Manual Operator shall be capable of operation by one person in either direction under no load condition.
  - 4. Replaceable Parts:
    - a. Include the main and arcing contact individually or as units, relays, and control devices.
    - b. Switch contacts and accessories shall be replaceable from the front without removing the switch from the cabinet and without removing main conductors.
  - 5. Sensing Relays:
    - a. Under voltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100% of nominal, and dropout voltage is adjustable from 75 to 98% of pickup value. Factory set for pickup at 90% and dropout at 85%.
    - b. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
    - c. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100% of nominal. Factory set for pickup at 90%. Pickup frequency shall be adjustable from 90 to 100% of nominal. Factory set for pickup at 95%.

- d. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
  - e. Test Switch: Simulate normal-source failure.
  - f. Switch-Position Pilot Lights: Indicate source to which load is connected.
  - g. Source-Available Indicating Lights: Supervise sources via transfer switch normal- and emergency-source sensing circuits.
  - h. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
  - i. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
  - j. Transfer Override Switch: Overrides automatic retransfer control so that automatic transfer switch shall remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
  - k. Engine Starting Contacts: One isolated and normally closed and one isolated and normally open; rated 10 A at 32-V dc minimum.
  - l. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
  - m. Engine-Generator Exerciser: Programmable exerciser starts engine-generator(s) and transfers load to them from normal source for a preset time, then retransfers and shuts down engine-generator(s) after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period.
6. Controls:
- a. Control module shall provide indication of switch status and be equipped with alarm diagnostics.
  - b. Control module shall control operation of the automatic Transfer switches.
7. Factory Wiring: Train and bundle factory wiring and label either by color-code or by numbered/lettered wire markers. Labels shall match those on the shop drawings.
8. Annunciation, Control, and Programming Interface Components: Devices for communicating with remote programming devices, annunciators, or control panels shall have open-protocol communication capability matched with remote device.
9. Auxiliary Contacts:
- a. Provide contacts as necessary to accomplish the functions shown on the drawings, as specified herein, and as designated in other sections of these specifications, as well as one spare normally open contact and one normally closed contact.
  - b. Provide remote contact to bypass retransfer time delay to normal source.

- c. Provide contacts for connection to elevator controllers, one closed when automatic transfer switch is connected to the normal source, and one closed when automatic transfer switch is connected to the emergency source
- 10. Elevator Pre-Transfer Signal Relay: Provide a pre-signal relay on all automatic transfer switches that will indicate to an elevator controller or controllers that a transfer or re-transfer is about to occur.
- 11. In-Phase Monitor: Factory-wired, internal relay controls transfer, so that it occurs only when the two sources are synchronized in phase. The relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70% or more of nominal voltage.

## 2.2 SEQUENCE OF OPERATION

- The specified voltage decrease in one or more phases of the normal power source shall initiate the transfer sequence. The automatic transfer switch shall start the engine-generator(s) after a specified time delay to permit override of momentary dips in the normal power source.
- B. The automatic transfer switch shall transfer the load from normal to emergency source when the frequency and voltage of the engine-generator(s) have attained the specified percent of rated value.
  - C. Engine Start: A voltage decrease, at any automatic transfer switch, in one or more phases of the normal power source to less than the specified value of normal shall start the engine-generator(s) after a specified time delay.
  - D. Transfer to Emergency System Loads: Automatic Transfer switches for emergency system loads shall transfer their loads from normal to emergency source when frequency and voltage of the engine-generator(s) have attained the specified percent of rated value. Only those switches with deficient normal source voltage shall transfer.
  - E. Transfer to Equipment Branch Loads: Automatic Transfer switches for equipment Branch loads shall transfer their loads to the generator on a time -delayed, staggered basis, after the emergency system switches have transferred. Only those switches with deficient normal source voltage shall transfer.
  - F. Retransfer to Normal (All Loads): Automatic transfer switches shall retransfer the load from emergency to normal source upon restoration of normal supply in all phases to the specified percent or more of normal voltage, and after a specified time delay. Should the emergency source fail during this time, the automatic transfer switches shall immediately transfer to the normal source whenever it becomes available. After restoring to normal source, the engine-generator(s) shall continue to run unloaded for a specified interval before shut down.
  - G. Exercise Mode: Transfer to emergency power source shall be accomplished by remote manual test switches on a selective basis.

## 2.3 BYPASS/ISOLATION SWITCH

- A. Provide each automatic transfer switch with two-way bypass/isolation manual type switch. The bypass/isolation switch shall permit load by-pass to either normal or emergency power source and complete

isolation of the automatic transfer switch, independent of transfer switch position. Bypass and isolation shall be possible under all conditions including when the automatic transfer switch is removed from service.

- B. Operation: The bypass/isolation switch shall have provisions for operation by one person through the movement of a maximum of two handles at a common dead front panel in no more than 15 seconds. Provide a lock, which must energize to unlock the bypass switch, to prevent bypassing to a dead source. Provide means to prevent simultaneous connection between normal and emergency sources.
  - 1. Bypass to normal (or emergency): Operation of bypass handle shall allow direct connection of the load to the normal (or emergency) source, without load interruption or by using a break-before-make design, or provide separate load interrupter contacts to momentarily interrupt the load.
    - a. Ensure continuity of auxiliary circuits necessary for proper operation of the system.
    - b. A red indicating lamp shall light when the automatic transfer switch is bypassed.
    - c. Bypassing source to source: If the power source is lost while in the bypass position, bypass to the alternate source shall be achievable without re-energization of the automatic transfer switch service and load connections.
  - 2. Isolation: Operation of the isolating handle shall isolate all live power conductors to the automatic transfer switch without interruption of the load.
    - a. Interlocking: Provide interlocking as part of the bypass/ isolation switch to eliminate personnel controlled sequence of operation, and to prevent operation to the isolation position until the bypass function has been completed.
    - b. Padlocking: Include provisions to padlock the isolating handle in the isolated position.
    - c. Visual verification: The isolation blades shall be visible in the isolated position.
  - 3. Testing: It shall be possible to test (normal electrical operation) the automatic transfer switch and engine generator(s) with the isolation contacts closed and the load bypassed without interruption of power to the load.
- C. Ratings: The electrical capabilities and ratings of the bypass/isolation switch shall be compatible with those of the associated automatic transfer switch, including any required additional withstand tests.
- D. Bypass switches shall comply with the NEC, NFPA and be UL listed for the service designated. All transfer switches shall be factory tested.

## **2.4 REMOTE ANNUNCIATOR SYSTEM**

- A. Remote annunciator panel shall annunciate conditions for indicated automatic transfer switches. Annunciation shall include the following:
  - 1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
  - 2. Switch position.
  - 3. Switch in test mode.
  - 4. Failure of communication link.
- B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.
  - 1. Indicating Lights: Grouped for each automatic transfer switch monitored.

2. Label each group, indicating the automatic transfer switch it monitors, the location of switch, and the identity of load it serves.
3. Mounting: Flush, modular steel cabinet, unless otherwise indicated.
4. Shall include a Lamp Test: either a Push-to-test or a lamp-test switch on front panel.

## **2.5. SPARE PARTS**

- A. Provide six control fuses for each automatic transfer switch with a different rating.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install the automatic transfer switch in accordance with the NEC, NFPA, as shown on the drawings, and as recommended by the manufacturer.
- B. Anchor control and annunciator panel to wall.
- C. For wall-mounted units, anchor automatic transfer switch to the wall with plated 0.5 in [12.5 mm] minimum anchor bolts, or as recommended by the manufacturer.
- D. For floor-mounted units, anchor automatic transfer switch to the slab with plated 0.5 in [12.5 mm] minimum anchor bolts, or as recommended by the manufacturer.
- E. For floor-mounted units, mount automatic transfer switch on concrete slab. Unless otherwise indicated, the slab shall be at least 4 in [100 mm] thick. The top of the concrete slab shall be approximately 4 in [100 mm] above finished floor. Edges above floor shall have 0.5 in [12.5 mm] chamfer. The slab shall be of adequate size to project at least 8 in [200 mm] beyond the equipment. Provide conduit turn-ups and adequate cable entrance space required for the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 3 in [75 mm] above the slab surface. Concrete work shall be as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.
- F. Set field-adjustable intervals and delays, relays, and engine exerciser.
- G. Ground equipment as shown on the drawings and as required by NFPA 70.

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

A factory-authorized service representative is required to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.

1. Following completion of automatic transfer switch installation and after making proper adjustments and settings, site tests shall be performed by the manufacturer's representative in accordance with manufacturer's written instructions to demonstrate that each automatic transfer switch functions satisfactorily and as specified. Advise COTR and Commissioning Agent of the site testing within five days prior to its scheduled date, and provide certified field test reports within 14 days following successful completion of the site tests. Test reports shall describe adjustments and settings made and site tests performed. Minimum operational tests shall include the following:
  - a. insulation resistance shall be tested, both phase -to -phase and phase -to -ground.
  - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.

- c. Verify that manual transfer warnings are properly placed.
  - d. Perform manual transfer operation.
- 2. After energizing circuits, demonstrate the interlocking sequence and operational function for each automatic transfer switch at least three times.
  - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
  - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
  - c. Verify time-delay settings.
  - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
  - e. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, re-transfer time delay on restoration of normal power, and engine cool-down and shut-down.
- 3. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
  - a. Verify grounding connections and locations and ratings of sensors.
  - b. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
  - c. Power failure of normal source shall be simulated by opening upstream protective device. This test shall be performed a minimum of five times.
  - d. Power failure of emergency source with normal source available shall be simulated by opening upstream protective device for emergency source. This test shall be performed a minimum of five times.
  - e. Low phase-to-ground voltage shall be simulated for each phase of normal source.
  - f. Operation and settings shall be verified for specified automatic transfer switch operational feature, such as override time delay, transfer time delay, return time delay, engine shutdown time delay, exerciser, auxiliary contacts, and supplemental features.
  - g. Manual and automatic transfer and bypass isolation functions shall be verified.
- h. When any defects are detected, correct the defects and repeat the test as requested by the COTR, at no additional cost to the Government.

### 3.3 DEMONSTRATION

At the final inspection in the presence of COTR and, VA representative, and Commissioning agent demonstrate that the complete auxiliary electrical power system operates properly in every respect.

Coordinate this demonstration with the demonstration of the engine-generator set.

### 3.4 TRAINING

Furnish the services of a competent, factory-trained engineer or technician for one (4) four-hour period for instructing VA personnel in operation and maintenance of the equipment, including review of the operation and maintenance manual, on a date requested by the COTR. Coordinate this training with that of the generator training.

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**SECTION 26 41 00**  
**FACILITY LIGHTNING PROTECTION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the furnishing and installation of a complete master labeled lightning protection system, complying with NFPA 780, UL 96 and UL 96A.

**1.2 RELATED WORK**

- A. Section 07 60 00, FLASHING AND SHEET METAL: penetrations through the roof.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground faults.

**1.3 QUALITY ASSURANCE**

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

**1.4 SUBMITTALS**

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Shop Drawings:
  - 1. Isometric and plan views showing layout and connections to the required metal surfaces.
  - 2. Show the methods of mounting the system to the adjacent construction.
- C. Qualifications: Submit proof that the installer of the lightning protection system is a certified Lightning Protection Institute (LPI) installer, and has had suitable and adequate experience installing other lightning protection systems, and is capable of installing the system as recommended by the manufacturer of the equipment.
- D. Certification: Three weeks prior to final inspection, submit four copies of the following certifications to the COTR:
  - 1. Certification that the lightning protection system has been properly installed and tested.



2. Certification that the lightning protection system has been inspected by a UL representative and has been approved by UL without variation.

### 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. National Fire Protection Association (NFPA):
  - 70.....National Electrical Code (NEC)
  - 780.....Standard for the Installation of Lightning Protection Systems
- C. Underwriters Laboratories, Inc. (UL):
  - 96.....Lightning Protection Components
  - 96A.....Installation Requirements for Lightning Protection Systems
  - UL 467 .....Standard for Grounding and Bonding Equipment

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Attach master labels to each item by its manufacturer as evidence that the materials have been manufactured in conformance with the UL Standards for master label lightning protection materials.
- B. In addition to conformance to UL 96, the component material requirements are as follows:
  1. Conductors: Electrical grade copper. Conductors shall be in accordance with NFPA 780 and UL 96 for Class I, Class II, or Class II modified materials as applicable.
  2. Air terminals: Solid copper, 18 inches long, not less than 3/8 inch [9mm] diameter, with sharp nickel-plated points.
  3. Ground rods: solid copper, not less than 1/2 inch [13mm] diameter by 8 feet [2400mm] long. Ground rods of copper-clad steel, steel, stainless steel, galvanized ferrous, and solid copper shall not be mixed on the project.
  4. Ground plates: Solid copper, not less than 1/16 inch [2mm] thick.
  5. Tubing: Stiff copper or brass.
- C. Anchors and fasteners shall be bolt type which are most suitable for the specific anchor and fastener installations. Clamp-type connectors for splicing conductors shall conform to UL 96, class as applicable,

and, Class 2, style and size as required for the installation. Clamp-type connectors shall only be used for the connection of the roof conductor to the air terminal and to the guttering. All other connections, bonds, and splices shall be done by exothermic welds or by high compression fittings. The exothermic welds and high compression fittings shall be listed for the purpose. The high compression fittings shall be the type which requires a hydraulically operated mechanism to apply a minimum of 10,000 psi.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Installation shall be coordinated with the roofing manufacturer and installer.
- B. Install the conductors as inconspicuously as practical and with the proper bends.
- C. Install the vertical conductors within the concealed cavity of exterior walls. Run the conductors to the exterior at elevations below the finished grade and make the ground connections to the earth outside of the building or stack perimeter.
- D. Make connections of dissimilar metal with bimetallic type fittings to prevent electrolytic action.
- E. Use the exothermic welding type connections that form solid metal joints in the main vertical and horizontal conductors, and for connections that are not exposed in the finish work.
- F. Protect copper conductors with stiff copper or brass tubing, which enclose the conductors from the top to the bottom of the tubing, between one foot [300mm] below and seven feet [2100mm] above the finished grade. The conductor shall be bonded to the top and bottom of the tubing.
- G. Sheath copper conductors, which pass over cast stone, cut stone, architectural concrete and masonry surfaces, with not less than a 1/16 inch [2mm] thickness of lead to prevent staining of the exterior finish surfaces.
- H. For the earth connections, install ground rods and ground plates, and the conductor connections to them and the main water pipes in the presence of the COTR. For the conductors located outside of the building, install the conductors not less than two feet [600mm] below the finished grade.

- I. For structural steel buildings, connect the steel framework of the buildings to the main water pipe near the water system entrance to the building.
- J. Connect lightning protection cables to all metallic projections, equipment, and components above the roof as indicated on the drawings.
- K. Connect exterior metal surfaces, located within three feet [900mm] of the lightning protection system conductors, to the lightning protection system conductors to prevent flashovers.
- L. Maintain horizontal or downward coursing of main conductor and insure that all bends have at least an 8-inch radius and do not exceed 90 degrees.
- M. Conductors shall be rigidly fastened every three feet [900mm] along the roof and down to the building to ground.
- N. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure. Install air terminal bases, cable holders and other roof-system supporting means without piercing roof metal.
- O. Use clamp supports to secure supporting means to roof standing seams only.
- P. Use through-roof connectors for down-conductor attachment to roof system. Provide flashing in accordance with Section 07 60 00, FLASHING AND SHEET METAL.
- Q. Down-conductors coursed on or in reinforced concrete columns or on structural steel columns shall be connected to the reinforcing steel or the structural steel member at its upper and lower extremities. In the case of long vertical members an additional connection shall be made at intervals not exceeding 100 feet [30m].
- R. A counterpoise, where shown, shall be of No. 1/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 2 feet [600mm] deep at a distance not less than 3 feet [900mm] nor more than 8 feet [2.5m] from the nearest point of the structure.
- T. Grounding: Test the ground resistance to earth by standard methods and conform to the ground resistance requirements specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- U. Where shown, use the structural steel framework or reinforcing steel as the main conductor:

1. Weld or bond the non-electrically-continuous sections together and make them electrically continuous.
  2. Verify the electrical continuity by measuring the ground resistances to earth at the ground level, at the top of the building or stack, and at intermediate points with a sensitive ohmmeter. Compare the resistance readings.
  3. Connect the air terminals together with an exterior conductor connected to the structural steel framework at not more than 60 foot [18m] intervals.
  4. Install ground connections to earth at not more than 60 foot [18m] intervals around the perimeter of the building.
  5. Weld or braze bonding plates, not less than 8 inches [200mm] square, to cleaned sections of the steel and connect the conductors to the plates.
  6. Do not pierce the structural steel in any manner. Connections to the structural steel shall conform to UL Publication No. 96A.
- X. When the lightning protection systems have been installed, have the systems inspected by a UL representative. Obtain and install a UL numbered master label for each of the lightning protection systems at the location directed by the UL representative and the Resident Engineer.
- Z. Metal fences that are electrically continuous with metal posts extending at least 2 feet [600mm] into the ground require no additional grounding. Other fences shall be grounded on each side of every gate. Fences shall be grounded by means of ground rods every 1000 to 1500 feet [300 to 450m] of length when fences are located in isolated places, and every 500 to 750 feet [150 to 225m] when in proximity (100 feet [30m] or less) to public roads, highways, and buildings.

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