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UPGRADE ELECTRICAL SYSTEM, BUILDING 2434
PROJECT NUMBER: KS00518-3J

SECTION 01 10 00
SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. The work to be performed under this project consists of providing the labor, equipment, and materials to complete the work for Upgrade Electrical System in Building 2434 as described in drawings, specifications and contract documents.

B. The work includes incidental related work.

1.2 LOCATION OF WORK

Work is located at Building 2434, Fort Sill, Oklahoma.

1.3 PRINCIPAL FEATURES

A. Demolition:

(1) Remove and replace existing asphalt pavement as indicated on the drawings.

(2) Remove and replace existing concrete pavement as indicated on the drawings.

B. New Work: Provide new electrical panelboard, circuit breakers, power meter, current transformers, ground rods, wires, conduits, safety switches, mounting racks, junction boxes, pad mounted transformer, guard posts, crossarms, fused cutouts, fuses, arresters, terminators, plastic coated rigid galvanized steel elbows, concrete encased schedule 40 PVC conduit and other associated items in accordance with the drawings and specifications.

C. Incidentals: The foregoing outline of principal features does not limit the responsibilities of the Contractor to perform all work and furnish all materials required by the drawings and specifications and to perform other work items that may be required or associated with this type of work.

D. Government Furnished Equipment and/or Material: NONE.

E. Hot Work Permit: the contractor shall request a hot work permit for the project.

1.4 CONTRACT DRAWINGS

A. The following drawings form a part of this contract.

Title	Drawing No.
Location Map and Drawing Index	23-016-a
Notes, Legend and Detail	23-016-E1
Notes and Plan	23-016-E2
Detail	23-016-E3
Notes, Plans and Detail	23-016-E4
Notes and Riser Diagram	23-016-E5
Schedules and Detail	23-016-E6
Details	23-016-E7
Notes and Plan	23-016-E8

B. One electronic set of contract drawings and specifications will be furnished to the Contractor. Hard copy of contract drawings will not be furnished. Reference publications will not be furnished.

C. Contractor shall immediately check furnished drawings and notify the Government of any discrepancies.

a. Record drawings of past work performed on the applicable facility may be on file at the Directorate of Public Works, Engineering Division, building 1950, and are available for review by the offerors during normal business hours. Copies will not be provided upon request. The Government assumes no responsibility for any deductions or conclusions made from record drawings. Proposals shall be based upon data obtained through contractor's field verification of existing conditions at the facility where work is to be performed.

1.5 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK

A. The Contractor will be required to commence work under this contract 10 calendar days after the date of receipt of notice to proceed, to prosecute said work diligently, and to complete the entire work ready to use no later than 370 calendar days after the date of receipt of notice to proceed. The time stated for completion shall include 10 weather days, receipt of approved As-Built drawings, receipt of approved Operation and Maintenance manuals, all final close out documents, mobilization and final clean up.

B. The Contractor will be required to submit a Payment Estimate – Contract Performance Statement, Fort Sill Form 94, in accordance with base specification section 01 32 00. Close out documents, to include As-Built

Drawings and Operations and Maintenance (O&M) Manuals shall be indicated as 15% of the job in section 11b.1 of FS Form 94. Liquidated Damages will be assessed if close out documents are not received and approved by the Government with the time period stated herein.

1.6 OPERATIONS SECURITY

A. Per AR 530-1 Operations Security, the contractor employees must complete Level I OPSEC Awareness training. New employees must be trained within 30 calendar days of their reporting for duty and annually thereafter.

END OF SECTION

SECTION 01 14 00

WORK RESTRICTIONS

PART 1 - GENERAL

1.1 REFERENCES

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

B. U.S. ARMY CORPS OF ENGINEERS (USACE) EM 385-1-1 Safety and Health Requirements Manual

1.2 MEASUREMENT AND PAYMENT

A. Payment for work under this contract and all costs associated shall be included in the applicable bid item to which the work pertains.

1.3 ASSIGNMENT OF WORK

A. Work will be assigned by the Contracting Officer only and will be in writing.

1.4 EXISTING WORK

A. Protect existing vegetation, structures, equipment, utilities, pavement and improvements. Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work to remain or to be reused.

B. Repair or replace portions of existing work that has been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work shall be in a condition equal to or better than that which existed before new work started.

1.5 INSPECTION OF WORK

A. Technical surveillance of workmanship and inspection of materials for work being performed for this project shall be the responsibility of the Directorate of Public Works.

B. This provision in no way authorizes anyone other than the Contracting Officer to commit the government to changes in the terms of the contract. (FAR Clause 52.246-12)

1.6 SUBMITTALS

A. Provide submittals as required by the base contract specification and the task order specifications in accordance with base specification section 01 33 00. Provide a submittal register for review and approval. The submittal register, (Excel Spreadsheet used in lieu of ENG Form 4288-R) is attached. The submittals listed on the submittal register may not be all inclusive and any submittal required in the specifications but not shown on this list is still a requirement of this task order. Provide submittal information to the Contracting Officer's Representative.

B. Government approval of submittals does not relieve the Contractor from providing all work in compliance with the contract.

C. As-Built Drawings: All sheets in the As-Built drawing set shall be dated and marked "As-Built". As-Built drawings shall reflect the actual as-built construction. The one half size hard copy and two electronic copies of the As-Built drawings shall be submitted to the Contracting Officer. The electronic copies shall be in PDF format and a format editable by Microstation V8i. The As-Builts are required for all specification sections whether or not specifically indicated in each individual section. The drawings shall be in accordance with AEC CAD Standard.

1.7 OCCUPANCY OF PREMISES

A. Before work is started, the Contractor shall arrange with the Contracting Officer a sequence of procedure, means of access, and space for storage of materials.

B. Coordination and notification of commencement of work shall be given to the appropriate building occupants a minimum of two weeks prior to beginning work in the affected areas with approval through the Contracting Officer.

C. The Contractor shall provide signs, barriers, and barricades to provide a safe work area and protect building occupant entry and egress.

1.8 ACCESS TO FORT SILL

A. Contractor Access to Fort Sill: Effective 30 January 2015, personnel requiring access to the installation shall possess a Common Access Card (CAC), Long Term Unescorted Access Pass or Military ID, or Individual temporary pass issued by the Fort Sill Directorate of Emergency Services (DES) pursuant to Army Directive 2014-05, Policy and Implementation Procedures for Common Access Card Credentialing and Installation Access for Un-cleared Contractors. Fort Sill will initiate a system which provides three forms of access documentation based upon the duration of required access and DOD Network requirements. The three forms are as follows: (1) Common Access Card (CAC); (2) Long Term Unescorted Access Pass or Military ID; or an (3) Individual Temporary Pass. The Contractor shall provide the COR the required documentation for each prime or sub-contract employee who requires a CAC or Long Term Unescorted Access Pass as described below within 10 calendar days of contract award. The COR will initiate and coordinate the process for obtaining Contractor CACs or Long Term Unescorted Passes (for contract employees not possessing a current CAC or military ID) with the Directorate of Emergency Services (DES). Failure to receive a Long Term Unescorted Access Pass or Individual Temporary Pass will result in the contractor personnel being denied admission to the installation.

1. Common Access Card (CAC): Contractor employees and staff (herein referred to as Contractors) requiring access to the installation on a recurring basis for a period of 6 months or more, and requiring access to a DOD computer network shall obtain a CAC. Contractor employees who do not require access to a DOD computer network are not eligible for a CAC but should apply for Long term, unescorted access as described below.

    a. CACs are issued through the Trusted Associate Sponsorship System (TASS) program. Issuance of a CAC requires a favorable Federal Bureau of Investigation (FBI) fingerprint check, successful submission of a National Agency Check with Inquiries (NACI) (equivalent or higher) background investigation to the Army’s investigative service provider and a favorably adjudicated NACI (equivalent or higher) investigation from a Federal department or agency.

    b. In order to avoid delays in gaining access to the installation, contractors requiring a CAC are encouraged to contact their Contracting Officer Representative (COR) to begin the process to obtain CACs as soon as possible.

2. Long Term, Unescorted Access Pass: This pass is required for Contractors, Sub-contractors and Vendors requiring physical access to the

installation on a recurring basis (greater than 24 hours) and who do not require access to a DOD computer network. The expiration date of the access will be the end of the contract period of performance or 365 day whichever comes first. Sub-contractors shall be bound by this same requirement. Prime Contractors are responsible for obtaining timely sub-contractor documents necessary to secure required access documents. Contractors and their employees shall pass a NCIC Interstate Identification Index check in order to secure this pass.

a. Military ID: Military ID cards for retirees, reservists and dependents are acceptable for unescorted access onto Fort Sill.

b. In order to avoid delays in gaining access to the installation, contractors are encouraged to contact their Contracting Officer Representative (COR) to begin the process of securing long term passes as soon as possible.

3. Individual Temporary Pass: All contractors and sub-contractors who do not possess a CAC, a valid Military ID, or a current long term unescorted pass shall report to the Visitors Control Center located near Sheridan gate to obtain an Individual temporary pass. A temporary pass will ONLY be issued to persons who produce a valid current federal or state issued ID with a picture, and passes a NCIC Interstate Identification Index check and local exclusion roster. Acceptable forms of ID are:

a. ID cards for installation access must be REAL ID Act complaint.

b. Valid current Permanent Resident Card or Alien Registration Receipt Card (Form I-551)

c. Valid current Employment Authorization Document (Card) that contains a photograph (Form I-766)

d. Passport (Foreign Passports must show point of entry stamp).

4. The contractor shall return issued CACs and Passes to the designated COR at the end of the contract period of performance or the end of the individual employee's tenure, whichever comes first. The contractor shall also coordinate with the COR for new or replacement CACs or Long Term Unescorted Passes as required.

5. For additional information, see:

a. https://sill-www.army.mil/vcc/

b. https://sill-www.army.mil/USAG/forms.html

c. Fort Sill unescorted access regulation (to be published).

d. Homeland Security Presidential Directive 12, Policy for a Common Identification Standard for Federal Employees and Contractors located at https://www.dhs.gov/homeland-security-presidential-directive-12#1

e. Army Regulation (AR) 190-13, the Army Physical Security Program located at https://www.fas.org/irp/doddir/army/ar190-13.pdf

1.9 ACCESS TO SITE

A. Normal duty hours for work shall be from 7:30 a.m. to 4:00 p.m., Monday through Friday. Access to the site shall be coordinated and approved by the Contracting Officer.

B. Requests for additional work periods shall require written approval from the Contracting Officer 7 days in advance of the proposed work period. Weekend work requests may be approved on a case by case basis if requested by the Wednesday prior to the desired weekend.

1.10 DEFINITIONS

A. Whenever the specifications require approval or selection of any item, it shall be construed to mean approval or selection by the Contracting Officer in writing.

B. Whenever the specifications require submittal of reports or certifications, it shall be construed to mean submitted to the Contracting Officer in writing.

C. Approvals made by the Contracting Officer prior to final project inspection and acceptance do not relieve the Contractor from his obligation to perform the work in accordance with the specifications and drawings. These approvals do not prohibit the Government from subsequently asserting any other contract rights under this contract.

1.11 SAFETY

A. Requirements of EM 385-1-1 shall be strictly enforced and adhered to at all time at the job sites.

B. The contractor shall adhere to the requirements of the Occupational Safety and Health Administration as applicable to all work activities.

C. Each contractor shall have a properly trained Safety Officer (OSHA 30-hour Construction) that is responsible for the overall safety program for the company. The Safety Officer shall be familiar with the requirements of EM385-1-1 and have experience in the areas of hazard identification and safety compliance. The Safety Officer shall make regular (minimum of 1 per week) safety inspections of each project site.

D. When working within six feet of any railroad track, the contractor shall ensure that all workers are trained in Blue Flag Protection in accordance with CFR49, part 218, the General Code of Operating Rules (GCOR), 5.13 and TM 4-14.21 Rail Safety; and are qualified on Roadway Worker Protection in accordance with CFR49, part 214.

1.12 SEQUENCING AND SCHEDULING

A. Contractor shall furnish the Contracting Officer a Contract Progress Schedule in the form of a Gantt chart that clearly shows the critical path for construction progress. See section 01 33 00 SUBMITTAL PROCEDURES for a detailed description of the Progress Schedule. The Progress Schedule shall include, but is not limited to, the following information:

1. Projected dates of the start and completion of work.
2. Projected start and completion dates of each major phase of construction.
3. Major submittals and submittal processing time.
4. Major equipment lead time.

B. Changes to the Progress Schedule shall be submitted by the Contractor to the Contracting Officer, in writing, two weeks prior to the scheduled start of the affected work on the job sites, or as directed by the Contracting Officer.

1.13 UTILITIES

A. All reasonable amounts of water, electricity, and gas required for the performance of the work under this contract will be made available to the Contractor by the Government from existing distribution systems at no cost to the Contractor.

B. Connection and disconnection shall be the responsibility of the contractor.

C. Connection and disconnection shall be made in a manner approved by the Government.

D. Abuse of this policy may result in disconnection from utilities.

E. Contractor shall submit an energy and water conservation plan.

1. The plan shall outline all expected activities that will consume water, electricity, and natural gas along with estimates of consumption.
2. Plan shall outline a plan to install any and all necessary meters (i.e. job trailers or buildings unoccupied with exception of the contractor). It shall include a detailed map showing the location of the meters. Contractor shall install all meters for temporary utility hookups.
3. All meters shall comply with all local codes and regulations and will include any additional equipment necessary such as backflow preventers. Contractor shall remove all temporary meters and equipment when project is completed.
4. Plan shall describe effort to comply with reporting standards stated herein and on the website https://sill-www.army.mil/USAG/dpw/BMB.html#tab-2.
5. Plan must demonstrate efforts to conserve electricity, natural gas and water in compliance with Ft. Sill policies and best management practices on conservation of electricity, natural gas, and water.
6. If there is a change in the project that will or may change the utility connection requirements, the Contractor shall submit a revised compliance plan to the Contracting Officer.
7. Contractor shall sign and return to the Contracting Officer a Memorandum of Understanding for Sale of Utility Services (DA2100-R) before utilities will be turned on.
8. Contractor shall report meter readings to the Contracting Officer or the Contracting Officer's Representative on the 15th of each month or immediately upon disconnection of utilities.
9. Meter readings shall be reported from the beginning of the construction to the completion of construction. This requirement includes recording meter readings from water points on post. The meter reading reports shall include project name and contract number.

1.14 SALVAGE MATERIAL AND EQUIPMENT

A. No salvage is required.

1.15 CLEAN UP

A. The job site shall be cleaned up on a daily basis.

B. All trash and debris, except metal, generated from the construction operation shall be delivered to the Fort Sill sanitary landfill or rubble pit as directed by the Contracting Officer.

C. All metal shall be disposed off Government property.

D. No material shall be burned at the project site. (FAR Clause 52.236-12)

1.16 CONDUCT OF EMPLOYEES

A. The Contractor's employees shall not be permitted to carry firearms or other lethal weapons while on Fort Sill in accordance with Fort Sill Regulation 190-1. Knives or other bladed instruments or tools are authorized for use only for the utilitarian purpose for which it was designed.

B. The contractor and the contractor’s employees shall adhere to the United States Army’s sexual harassment and rape prevention (SHARP) policies and regulations in addition to state and federal laws.

1. Army’s Policy on sexual harassment
   a. Sexual harassment is unacceptable and will not be tolerated.
   b. Sexual harassment destroys teamwork and negatively affects combat readiness.
   c. Army leadership at all levels will be committed to creating an environment conducive to maximum productivity and respect for human dignity.
   d. The success of the mission can be achieved only in an environment free of sexual harassment for all personnel.
   e. The Army’s SHARP policies apply without regard to a person’s rank, age, gender, and are sexual orientation neutral. A person’s sexual orientation is a personal and private matter.

2. Army Policy on Sexual Assault
   a. Sexual assault is a criminal offense.
   b. It degrades mission readiness.
   c. Soldiers and civilians who are aware of a sexual assault incident should report it immediately (within 24 hours).
   d. Sexual assault is incompatible with Army Values and is punishable under the UCMJ and other federal and local civilian laws.
   e. The Army’s SHARP policies apply without regard to a person’s rank, age, gender and sexual orientation neutral. A person’s sexual orientation is a personal and private matter.
   f. All victims of sexual assault will be treated with dignity, fairness, and respect.

3. SHARP Contact information

a. 911
b. Department of Defense Safe Helpline (https://www.safehelpline.org/) Helpline: 1-877-995-5247
c. RAINN (Rape, Abuse, and Incest National Network, https://www.rainn.org/) National Sexual Assault Hotline: 1-800-656-HOPE (4673)
d. Oklahoma Coalition Against Domestic Violence and Sexual Assault (https://www.ocadvsa.org/) Oklahoma Safe line: 1-800-522-7233
e. Sexual assault victim advocate and counseling available FREE of charge. https://www.mariedetty.com/ Hotline: (580) 357-2500 Office: (580) 357-6141

4. References
a. 29 CFR Part 1614
b. AR 600-20
c. AR 690-600
d. Title 42 United States Code Chapter 21 Subchapter VI

1.17 WORK FORCE

A. The contractor shall not hire persons not legally residing in the United States. The contractor shall not subcontract work to companies that hire persons not legally residing in the United States.

1.18 IDENTIFICATION OF CONTRACTOR EMPLOYEES AND VEHICLES

A. Each side of Contractor-owned vehicles shall bear the Contractor's name in 2-inch letters.

B. Each Contractor employee shall possess an identification card to include employee's name, name of Contractor, current photo, and card serial number. Additionally, each Contractor employee shall display on his/her person a badge or nametag which shall include the name of the employee and the Contractor's name.

C. The Contractor shall collect Contractor-furnished identification badges upon termination of employee.

1.19 APACHE GATE DELIVERY INFORMATION

A. All delivery trucks, transportation trucks, vehicles pulling trailers, every type of cargo or construction vehicle must enter through Apache Gate. Location of Apache Gate: Take the Medicine Park exit 45 off Interstate 44, proceed west

on highway 49 (approximately 1/2 mile). Entrance to Apache Gate is on the left (south).

1.20 ANTITERRORISM (AT)

A. Access and General Protection/Security Policy and Procedures: Contractor and all associated sub-contractors' employees shall comply with applicable installation, facility, and area commander installation/facility access and local security policies and procedures (provided by government representative). The contractor shall also provide all information required for background checks to meet installation access requirements to be accomplished by installation Provost Marshal Office, Director of Emergency Services, or Security Office. Contractor workforce must comply with all personal identity verification requirements as directed by DOD, HQDA, and/or local policy. In addition to the changes otherwise authorized by the changes clause of this contract, should the Force Protection Condition (FPCON) at any individual facility or installation change, the Government may require changes in contractor security matters or processes.

B. The Contractor must pre-screen Candidates using the E-verify Program (https://www.uscis.gov/e-verify) website to meet the established employment eligibility requirements. The Vendor must ensure that the Candidate has two valid forms of Government issued identification prior to ensure the correct information is entered into the E-verify system. An initial list of verified/eligible Candidates must be provided to the COR no later than 3 business days after the initial contract award.

C. All contractor employees, to include subcontractor employees, requiring access to Army installations, facilities, and controlled access areas shall complete AT Level I awareness training within 30 calendar days after contract start date or effective date of incorporation of this requirement into the contract, whichever is applicable. The contractor shall submit certificates of completion for each affected contractor employee and subcontractor employee to the COR or to the KO, if a COR is not assigned within 10 calendar days after completion of training by all employees and subcontractor personnel. AT level I awareness training is available at the following website: https://jko.jten.mil/courses/atl1/launch.html.

D. The contractor and all associated sub-contractors shall brief all employees on the local iWATCH program (training standards provided by the requiring activity ATO). This locally-developed training will be used to inform employees of the types of behavior to watch for and instruct employees to report suspicious activity to the COR. This training shall be completed within 30 calendar days of contract award and within 14 calendar days of new employees commencing performance with the results reported to the COR

NLT 35 calendar days after contract award. This training may be accomplished may be accomplished by viewing the video at the following website: https://www.myarmyonesource.com/familyprogramsandservices/iwatchprogram/default.aspx (Click on Anti-Terrorism video in center of page, Always Ready, Always Alert and iWatch News Clip).

PART 2 - PRODUCTS
NOT USED

PART 3 - EXECUTION
NOT USED

-- END OF SECTION --

UPGRADE ELECTRICAL SYSTEM, BUILDING 2434

SPECIFICATIONS

SECTION 16A

ELECTRICAL WORK, INTERIOR AND EXTERIOR

1. The installation shall conform to the requirements of the latest edition of NFPA 70 and ANSI C2, unless more stringent requirements are specified.

2. All utilities and any items damaged by construction operations shall be restored to its original condition by workers skilled in trades involved, at no additional cost to the government.

3. Contractor shall provide temporary power as required to keep the facilities in operation during the construction period.

4. Contractor shall arrange a work schedule with contracting officer and user two weeks prior to starting any work.

5. All exposed noncurrent carrying metallic parts of electrical equipment, metallic boxes and conduits, grounding conductor and neutral conductor shall be grounded.

6. Identification nameplates: Each electrical equipment shall be permanently marked with an identification nameplate to identify the equipment by type, or function and specific unit number as indicated. All identification nameplates shall be made of laminated plastic with black outer layers and a white core. Letters of identification nameplates shall be ¼ inch high minimum.

7. All conductors and busses shall be copper.

8. Interior low voltage conductors shall be Type THHN.

9. Exterior low voltage conductors shall be Type RHW-2 with XLP insulation.

10. A green equipment-grounding conductor shall be provided in each conduit.

11. Unless otherwise specified on the drawings, all interior wires shall be #12 THHN minimum.

12. Unless otherwise specified on the drawings, all exterior wires shall be #12 RHW-2 minimum.

13. Conduits shall be ½" minimum.

14. Unless otherwise indicated on the drawings, all exterior wires shall be installed in rigid galvanized steel (RGS) conduits.

15. Unless otherwise specified on the drawings, all interior wires shall be installed in electric metallic tubing (EMT). All conduits shall be concealed within existing ceilings, except those conduits in open ceilings, electrical room, and mechanical rooms or on existing concrete masonry unit walls. Only metal conduits shall be permitted when conduits are required for shielding or other special purposes indicated, or when required by conformance to NFPA 70. The conduit or tubing system shall be provided with appropriate boxes, covers, clamps, screws or other appropriate type of fittings. EMT may be installed only within buildings. EMT may be installed in concrete and grout in dry locations. EMT installed in concrete or grout shall be provided with concrete tight fittings. EMT shall not be installed in damp or wet locations, or the air space of exterior masonry cavity walls. Bushings, manufactured fittings or boxes providing equivalent means of protection shall be installed on the ends of all conduits and shall be of the insulating type, where required by NFPA 70. Adapters shall be used to connect EMT to rigid metal conduit, cast boxes, and conduit bodies. Penetrations of above grade floor slabs, time-rated partitions and fire walls shall be firestopped. Raceways shall not be installed under the firepits of boilers and furnaces and shall be kept 6 inches away from parallel runs of flues, steam pipes and hot-water pipes. Raceways crossing structural expansion joints or seismic joints shall be provided with suitable expansion fittings or other suitable means to compensate for the building expansion and contraction and to provide for continuity of grounding.

16. Boxes shall be provided in the wiring or raceway systems where required by NFPA 70 for pulling of wires, making connections, and mounting of devices or fixtures. Pull boxes shall be furnished with screw-fastened covers. Each box shall have not less than the volume required by NFPA 70 for number of conductors enclosed in box. Boxes shall be galvanized sheet steel.

17. Hardware shall be provided as required. Hardware shall be hot-dip galvanized in accordance with ASTM A 153.

18. All phase conductors shall be identified by color coding. Phase identification by a particular color shall be maintained continuously for the length of a circuit, including junctions. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in the same raceway or box, other neutral shall be white with colored (not green) stripe.

19. The color of the insulation on the phase conductors of 120/208 volt, 3-phase system, shall be red, black and blue.

20. Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may be furnished and identified by the use of half-lapped bands of colored electrical tape wrapped around the insulation for a minimum of 3 inches of length near the end, or other method as submitted by the Contractor and approved by the Contracting Officer.

21. Control and signal circuit conductor identification shall be made by color-coded insulated conductors, plastic-coated self-sticking printed markers, permanently attached stamped metal foil markers, or equivalent means as approved. Control circuit terminals of equipment shall be properly identified. Terminal and conductor identification shall match that shown on approved detail drawings. Hand lettering or marking is not acceptable.

22. Exposed raceways shall be installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Exposed conduits shall be painted to match adjacent surface, except those conduits in open ceilings, electrical room or mechanical rooms.

23. Changes in direction of conduit runs shall be made with symmetrical bends or cast-metal fittings. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Crushed or deformed raceways shall not be installed. Trapped raceways in damp and wet locations shall be avoided where possible. Lodgment of plaster, dirt, or trash in raceways, boxes, fittings and equipment shall be prevented during the course of construction. Clogged raceways shall be cleared of obstructions or shall be replaced.

24. Panelboards shall be as indicated on the drawings.

25. Panelboard directories shall be typed to indicate loads served by each circuit and mounted in a holder behind a clear protective covering.

26. Circuit breakers shall be bolt-on thermal-magnetic type, and shall have interrupting capacity of 22,000A minimum.

27. Electronic pulse meter shall be compatible with and incorporated into the Fort Sill Energy Management and Control System (EMCS) by using single loop digital sensors and controllers. Contractor shall connect the meter to EMCS. The electronic pulse meter shall include, at a minimum, phase currents, phase to phase voltages, kW, kWH, kVAR, kVA, power factor, frequency and

KYZ output. The electronic pulse meter shall be similar to Square D Powerlogic power meter, catalog number PM5500.

28. Current transformers shall be as indicated on the drawings.

29. Safety switches shall be as indicated on the drawings.

30. Equipment provided under this contract shall be provided with a complete set of properly rated fuses when the equipment manufacturer utilizes fuses in the manufacture of the equipment. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage.

31. Low-voltage fuses shall be Class RK1, current-limiting, dual element, time-delay with 200,000 amperes interrupting capacity.

32. The exterior conduits installed above grade shall be rigid galvanized steel (RGS). The RGS conduits shall be protected against corrosion where in contact with earth.

33. The RGS elbows installed in earth shall be plastic coated.

34. Underground conductors shall be Type RHW-2 with XLP insulation.

35. Underground secondary circuits shall be installed in direct-burial Schedule 40 PVC conduits.

36. Ducts shall be schedule 40 PVC conduits, with fittings suitable for the application. Number and size of ducts shall be as indicated on the drawings.

37. Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

38. Joints in each type of duct shall be made up in accordance with the manufacturer's recommendations for the particular type of duct and coupling selected and as approved by the Contracting Officer.

39. Duct joints shall be made by brushing plastic solvent cement on insides of plastic coupling fittings and on outsides of duct ends. Each duct and fitting shall then be slipped together with a quick 1/4-turn twist to set the joint tightly.

40. Electrical warning tape shall be provided for all underground circuits. A 5-mil brightly colored plastic tape, not less than 6 inches in width and suitably

inscribed at not more than 10 feet on centers with a continuous metallic backing and a corrosion-resistant 1-mil metallic foil core to permit for easy to locate the duct line, shall be placed approximately 12 inches below finished grade levels of trenches.

41. Pad-mounted transformer: Pad-mounted transformer shall be of self-cooled, loop feed, dead front and outdoor type. The transformer shall be 95 kV BIL, and 65 degrees C temperature rise. The transformer shall be non-PCB type, and shall have oil-immersed unit with 2 separate winding per phase. Windings shall be copper. Transformer shall be assembled and coordinated by one manufacturer, and shall be shipped as a complete unit so that field installation requirements are limited to mounting the unit on a concrete pad and connecting it to primary and secondary lines. Transformer shall be provided with a corrosion-resistant finish. Stainless steel pins and hinges shall be provided. Barriers shall be provided between high-voltage and low-voltage compartments. High-voltage compartment door shall be interlocked with low-voltage compartment door to prevent access to any high-voltage section unless its associated low-voltage door has first been opened. Compartments shall be sized to meet the specific requirements of ANSI C57.12.26. Pentahead locking bolts shall be provided with provisions for a padlock. The high-voltage compartment shall be dead-front construction. Primary switching and protective devices shall include load-break switching, oil-immersed, bayonet-type, overload fuses in series with a partial range current-limiting fuses, medium-voltage separable load-break connectors, universal bushing wells and inserts or integral one piece bushings surge arresters. The switch shall be mounted inside transformer tank with switch operating handle located in high-voltage compartment and equipped with metal loop for hook stick operation. Fuses shall be interlocked with switches so that the fuses can be removed only when the associated switch in the “OPEN” position. Adjacent to medium-voltage cable connections, a nameplate or equivalent stencilled inscription shall be provided inscribed “DO NOT OPEN CABLE CONNECTORS UNLESS SWITCH IS OPEN”. Surge arresters shall be fully insulated and configured to terminate the same bushing as the primary cable by means of a load-break, feed-through bushing insert. The load-break switch shall be radial-feed oil-immersed type rated at 15 kV, 95 kV BIL, with a continuous current rating and load-break rating of 200 amperes, and a make-and-latch rating of 10,000 rms amperes symmetrical. Standard NEMA primary taps shall be provided. Where primary taps are not specified, four 2-1/2 percent rated kVA high-voltage taps shall be provided 2 above and 2 below rated primary voltage. Operating handle of primary tap changer for de-energized operation shall be located within high-voltage compartment, externally to transformer tank. Adjacent to the tap changer-operating handle, a nameplate or equivalent stencilled inscription shall be provided inscribed “DO NOT OPERATE UNDER LOAD”. Instruction nameplates shall include the number of gallons of transformer oil. High-voltage warning signs shall be permanently attached to each side of the transformer. Stainless steel ground

connection pads shall be provided in both high-voltage and low-voltage compartments. Dial-type thermometer, liquid-level gage, and drain valve with built-in sampling device shall be provided for the transformer. A concrete pad shall be provided for the installation of the transformer.

42. Transformers shall be carefully installed so as not to scratch finishes. Transformers shall be installed in accordance with the manufacturer's instructions. After installation, surfaces shall be inspected and scratches shall be touched up with a finish provided by the transformer manufacturer for this purpose.

43. Liquid-Filled Transformer Nameplates: Nameplates shall indicate the number of gallons and composition of liquid-dielectric, and shall be permanently marked with a statement that the transformer dielectric to be supplied is non-polychlorinated biphenyl (PCB). If transformer nameplate is not so marked, the Contractor shall furnish manufacturer's certification for each transformer that the dielectric in non-PCB classified, with less than 50 ppm PCB content. Certifications shall be related to serial numbers on transformer nameplates. Transformer dielectric exceeding the 50 ppm PCB content or transformers without certification will be considered as PCB insulated and will not be accepted.

44. Nameplates: Each major component shall have the manufacturer's name, address, type or style, model or serial number, kVA, voltages, amperes, phase and catalog number on a nameplate securely attached to exterior surface of the equipment. Nameplates shall be made of noncorrosive metal.

45. Surge arresters: Surge arresters shall comply with NEMA LA 1, IEEE C62.1 and IEEE C62.11, and shall be provided for protection of transformer and other equipment. Arresters shall be distribution class, rated 10 kV. Arresters shall be equipped with mounting brackets. Arresters shall be of the metal-oxide varistor type suitable for outdoor installation.

46. Underground primary conductors shall be 15 kV shielded type with XLP insulation and shall have 133% insulation level.

47. Underground primary conductors shall be installed in concrete encased Schedule 40 PVC.

48. Installation Engineer: After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of equipment, assist in the performance of the onsite tests, oversee initial operations, and instruct personnel as to the operational and maintenance features of the equipment.

49. Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 14 days prior to conducting tests. The Contractor shall furnish all materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform all tests. The Contractor shall maintain a written record of all tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. All field test reports shall be signed and dated by the Contractor.

50. Safety: The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

51. Onsite Training: The Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total of 8 hours of normal working time and shall start after the system is functionally completed but prior to final acceptance tests. The course instruction shall cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as all major elements of the operation and maintenance manuals. Additionally, the course instructions shall demonstrate all routine maintenance operations.

52. Acceptance: Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

53. Contractor shall submit a complete list of equipment and materials for approval.

54. The label or listing of the Underwriter Laboratories (UL) will be accepted as evidence that materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with the procedures and that the materials and equipment comply with all contract requirements will be accepted. Materials and equipment will be approved based on the manufacturer’s published data. For other than materials and equipment specified to conform to UL publications, a manufacturer’s statement indicating complete compliance with the applicable standard of the American Society for Testing and Materials, National Electrical Manufacturers Association, FAA, or other commercial standard, is acceptable.

55. The following items shall be submitted for approval:

    a. Safety switches.

b. Conduits
c. Wires.
d. Circuit breakers.
e. Junction boxes.
f. Panelboards.
g. Electronic pulse meter
h. Current transformers.
i. Pad mounted transformer.
j. Ground rods.

END OF SECTION

UPGRADE ELECTRICAL SYSTEM, BUILDING 2434

SPECIFICATIONS

SECTION 16370
ELECTRICAL DISTRIBUTION SYSTEM, AERIAL

PART 1 GENERAL

1.1 SUBMITTALS

The following shall be submitted:

Materials shown on Drawing E3 shall be submitted for approval.

Manufacturer's Catalog

Submit data composed of catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

Material, Equipment, and Fixture Lists

A complete itemized listing of equipment and materials proposed for incorporation into the work shall be submitted. Each entry shall include the item number, the quantity of items proposed, and the name of the manufacturer of the item.

Installation Procedures

Procedures shall include instructions and precautions required to install, connect and put into service.

Drawings

Electrical Distribution System

Detail drawings shall consist of equipment drawings, illustrations, schedules, instructions, diagrams and other information necessary to define the installation and enable the Government to check conformity with the requirements of the contract drawings.

As-Built Drawings

The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be kept at the job site and

updated daily. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. The as-built drawings shall be complete and show the location, dimensions, part identification, and other information. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor's quality control representative and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within ten calendar days from the time the drawings are returned to the Contractor.

SD-09 Reports

Field Testing

A proposed field test plan shall be submitted 30 days prior to testing the installed system. No field test shall be performed until the test plan is approved. The test plan shall consist of complete field test procedures including tests to be performed, test equipment required, and tolerance limits.

Test Reports

Contractor shall submit six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of 5 rings, and including a separate section for each test. Sections shall be separated by heavy plastic dividers with tabs.

a. A list of equipment used, with calibration certifications.
b. A copy of measurements taken.
c. The dates of testing.
d. The equipment and values to be verified.
e. The condition specified for the test.
f. The test results, signed and dated.
g. A description of adjustments made.

Certificates

Materials and Equipment

Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronic Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided under this section of the specifications conform to such requirements. The label of, or listing by, UL will be acceptable as evidence that the items conform thereto. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms thereto. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms thereto. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested

and that they conform to the requirements listed, including methods of testing of the specified agencies.

1.2 DELIVERY, STORAGE, AND HANDLING

Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

Products shall conform to the following requirements. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 STANDARD PRODUCT

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.3 NAMEPLATES

2.3.1 General

Each major component shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a nameplate securely attached to the equipment. Nameplates shall be made of noncorrosive metal.

2.4 CORROSION PROTECTION

2.4.1 Aluminum Materials

Aluminum shall not be used in contact with earth or concrete. Where aluminum conductors are connected to dissimilar metal, fittings conforming to UL 486B shall be used.

2.4.2 Ferrous Metal Materials

2.4.2.1 Hardware

Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M and ASTM A 123/A 123M

2.4.2.2 Equipment

Equipment and component items, including but not limited to ferrous metal luminaires not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 120 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1/16 inch from

the test mark. The described test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

2.5 CONDUCTORS, CONNECTORS, AND SPLICES

2.5.1 Copper Conductors

Hard-drawn-copper conductors shall comply with ASTM B 1 and ASTM B 8 as appropriate for the conductor size.

2.5.2 Aluminum-Composition Conductors

Aluminum-conductor-steel-reinforced, ACSR, shall comply with ASTM B 232.

2.5.3 Conductor-To-Insulator Attachments

Conductors shall be attached to insulators by means of clamps, shoes or tie wires, in accordance with the type of insulator. For insulators requiring conductor tie-wire attachments, tie-wire sizes shall be as indicated in TABLE III.

TABLE III

TIE-WIRE REQUIREMENTS

CONDUCTOR	**TIE WIRE**
Copper (AWG)	**Soft-Drawn Copper** (AWG)
6	8
4 and 2	6
1 through 3/0	4
4/0 and larger	2
AAC, AAAC, or ACSR (AWG)	**AAAC OR AAC** (AWG)
Any size	6 or 4

2.5.4 Connectors and Splices

Connectors and splices shall be of copper alloys for copper conductors, aluminum alloys for aluminum-composition conductors, and a type designed to minimize galvanic corrosion for copper to aluminum-composition conductors. Aluminum-composition and aluminum-composition to copper shall comply with UL 486B, and copper-to-copper shall comply with UL 486A.

2.6 MEDIUM-VOLTAGE LINES

Bare medium-voltage line conductors shall be hard-drawn-copper conductors. Conductors larger than No. 2 AWG shall be stranded.

2.7 POLES AND HARDWARE

2.7.1 Pole Line Hardware

Zinc-coated hardware shall comply with ANSI C135.1, ANSI C135.2, ANSI C135.4, ANSI C135.14 and ANSI C135.22. Steel hardware shall comply with ASTM A 575 and ASTM A 576. Hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M. Pole-line hardware shall be hot-dip galvanized steel. Washers shall be installed under boltheads and nuts on wood surfaces and elsewhere as required. Washers used on through-bolts and double-arming bolts shall be approximately 2-1/4 inches square and 3/16 inch thick. The diameter of holes in washers shall be the correct standard size for the bolt on which a washer is used. Washers for use under heads of carriage-bolts shall be of the proper size to fit over square shanks of bolts. Eye bolts, bolt eyes, eyenuts, strain-load plates, lag screws, guy clamps, fasteners, hooks, shims, and clevises shall be used wherever required to support and to protect poles, brackets, guy wires, and insulators.

2.8 INSULATORS

Insulators shall comply with NEMA HV 2 for general requirements. Suspension insulators shall be used at corners, angles, dead-ends, other areas where line insulators do not provide adequate strength, and as indicated. Mechanical strength of suspension insulators and hardware shall exceed the rated breaking strength of the attached conductors.

2.8.1 Medium-Voltage Line Insulators

Medium-voltage line insulators shall comply with ANSI C29.2, ANSI C29.5, and ANSI C29.6, and as applicable. Ratings shall not be lower than the ANSI classes indicated in TABLE I. Pin insulators may be used for crossarm construction. Pin insulators for use on voltages in excess of 6 kV phase-to-phase shall be radio-interference-freed or else line-post insulators shall be used.

TABLE I

MINIMUM ANSI RATING OF MEDIUM-VOLTAGE INSULATORS BY CLASS

Voltage Level	Line-Post	Pin	Suspension
6 kV to 15 kV	57-1 or 11 57-2 or 12	55-5 56-3	Two 52-2 Two 52-3 or 4

2.9 CROSSARM ASSEMBLIES

Crossarms shall comply with REA Bulletin 1728H-701 and shall be solid wood, distribution type, except cross-sectional area with pressure treatment conforming to AWPA C25, and a 1/4 inch, 45 degree chamfer on all top edges. Cross-sectional area minimum dimensions shall be 4-1/4 inches in height by 3-l/4 inches in depth in accordance with IEEE C2 for Grade B construction. Crossarms shall be 8 feet in length. Crossarms shall be machined, chamfered, trimmed, and bored for stud and bolt holes before pressure treatment. Factory drilling shall be provided for pole and brace mounting, for four pin or four vertical line-post insulators, and for four suspension insulators, except where otherwise indicated or required. Drilling shall provide required climbing space and wire clearances.

Crossarms shall be straight and free of twists to within 1/10 inch per foot of length. Bend or twist shall be in one direction only.

2.10 FUSE CUTOUTS

Medium-voltage fuses and cutouts shall comply with NEMA SG 2 and shall be of the loadbreak type rated 100A, 15kV and of the extra-heavy-duty type. Open-link cutouts are not acceptable. Fuses shall be dropout type. Fuse ratings shall be as indicated. Fuse cutouts shall be equipped with mounting brackets suitable for the indicated installations.

2.11 SURGE ARRESTERS

Surge arresters shall comply with NEMA LA 1 and IEEE C62.1, IEEE C62.2, and IEEE C62.11. Arresters shall be distribution class, rated as shown. Arresters shall be equipped with mounting brackets suitable for the indicated installations. Arresters shall be of the metal-oxide varistor type suitable for outdoor installations.

2.12 GROUNDING AND BONDING

2.12.1 Driven Ground Rods

Ground rods shall be of copper-clad steel conforming to UL 467 not less than 3/4 in diameter by 10 feet in length driven full length into the earth.

2.12.2 Grounding Conductors

Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as the phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Equipment and devices shall be installed and energized in accordance with the manufacturer's published instructions.

3.1.1 Conformance to Codes

The installation shall comply with the requirements and recommendations of IEEE C2 for heavy loading districts, Grade B construction. No reduction in clearance shall be made. The installation shall also comply with the applicable parts of NFPA 70.

3.1.2 Verification of Dimensions

The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall notify the Contracting Officer of any discrepancy in writing before performing any work.

3.2 POLE INSTALLATION

3.2.1 Riser Pole

Provide new equipment information plate on the riser pole. The new equipment information plate shall indicate the ratings of arrester and size of primary fuse. The new equipment information plate shall be made of metal and shall be mounted on the pole 5 feet above grade.

3.3 CROSSARM MOUNTING

Crossarms shall be bolted to poles with 5/8 inch through-bolts with square washers at each end. Bolts shall extend not less than 1/8 inch nor more than 2 inches beyond nuts. On single crossarm construction, the bolt head shall be installed on the crossarm side of the pole. Metal crossarm braces shall be provided on crossarms. Flat braces shall be provided for 8 foot crossarms and shall be 1/4 by 1-1/4 inches, not less than 28 inches in length. Flat braces shall be bolted to arms with 3/8 inch carriage bolts with round or square washers between boltheads and crossarms, and secured to poles with 1/2 by 4 inch lag screws after crossarms are leveled and aligned. Double crossarms shall be securely held in position by means of 5/8 inch double-arming bolts. Each double-arming bolt shall be equipped with four nuts and four square washers.

3.3.1 Equipment Arms

Equipment arms shall be set parallel or at right angles to lines as required to provide climbing space. Equipment arms shall be located below line construction to provide necessary wire and equipment clearances.

3.4 CONDUCTOR INSTALLATION

3.4.1 Connectors and Splices

Connectors and splices shall be mechanically and electrically secure under tension and shall be of the nonbolted compression type. The tensile strength of any splice shall be not less than the rated breaking strength of the conductor. Splice materials, sleeves, fittings, and connectors shall be noncorrosive and shall not adversely affect conductors. Aluminum-composition conductors shall be wire brushed and an oxide inhibitor applied before making a compression connection. Connectors which are factory-filled with an inhibitor are acceptable. Inhibitors and compression tools shall be of types recommended by the connector manufacturer. Low-voltage connectors for copper conductors shall be of the solderless pressure type. Noninsulated connectors shall be smoothly taped to provide a waterproof insulation equivalent to the original insulation, when installed on insulated conductors. On overhead connections of aluminum and copper, the aluminum shall be installed above the copper.

3.5 CONNECTIONS TO UTILITY LINES

The Contractor shall coordinate the work with the Contracting Officer Representative(COR) and utility company a minimum seven days prior to the connections to the utility lines, and shall provide for the final connections to the utility lines.

3.6 GROUNDING

Noncurrent-carrying metal parts of equipment and conductor assemblies, such as luminaires, messengers, guy wires, and other noncurrent-carrying metal items shall be grounded. Additional grounding of equipment and neutral shall be installed at poles where indicated.

3.6.1 Grounding Electrodes

Grounding electrodes shall be installed as follows:

a. Driven rod electrodes - Unless otherwise indicated, ground rods shall be located approximately 3 feet out from base of the pole and shall be driven into the earth until the tops of the rods are approximately 1 foot below finished grade. Multiple rods shall be evenly spaced at least 10 feet apart and connected together 2 feet below grade.

b. Ground Resistance - The maximum resistance of a driven ground rod shall not exceed 25 ohms under normally dry conditions. Whenever the required ground resistance is not met, provide additional electrodes interconnected with grounding conductors, to achieve the specified ground resistance. The additional electrodes will be up to three 10-foot rods spaced a minimum of 10 feet apart. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors.

3.6.2 Grounding and Bonding Connections

Connections above grade shall be made by the fusion-welding process or with bolted solderless connectors in compliance with UL 467, and those below grade shall be made by a fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

3.6.3 Grounding Electrode Conductors

Grounding electrode conductors shall be sized as shown. Grounding electrode conductors shall be stapled to wood poles at intervals not exceeding 2 feet. Bends greater than 45 degrees in grounding electrode conductor are not permitted.

3.7 FIELD TESTING

3.7.1 General

Field testing shall be performed in the presence of the Contracting Officer. The Contractor shall notify the Contracting Officer 3 days prior to conducting tests. The Contractor shall furnish materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform tests and inspections recommended by the manufacturer unless specifically waived by the Contracting Officer. The Contractor shall maintain a written record of tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Field reports will be signed and dated by the Contractor.

3.7.2 Safety

The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

3.7.3 Ground-Resistance Tests

The resistance of each pole ground shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less 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 shall be provided.

3.7.4 Operating Tests

After the installation is completed, and at such time as the Contracting Officer may direct, the Contractor shall conduct operating tests for approval. The equipment shall be demonstrated to operate in accordance with the specified requirements. An operating test report shall be submitted in accordance with paragraph SUBMITTALS.

3.8 ACCEPTANCE

Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected.

END OF SECTION