# SECTION 26 13 00
# MEDIUM-VOLTAGE SWITCHGEAR

## PART 1 - GENERAL

### 1.1 DESCRIPTION

A. This section details the specifics of the existing Square D Substation Walk In high voltage switchgear, and is furnished as a REFERENCE ONLY to the existing equipment this contract will connect conductors to. None of the work or equipment described in this section are part of this contract, but are furnished as REFERENCE ONLY so the contractor has an adequate understanding of the existing in place equipment this contract will encounter during the installation, termination, and energization of conductors installed under this contract.

### 1.2 RELATED WORK

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

B. Section 26 05 13, MEDIUM-VOLTAGE CABLES: High voltage cables and splices.

C. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

### 1.3 QUALITY ASSURANCE

A. Factory Testing:

1. Thoroughly test the switchgear at the factory with the circuit breakers in the connected position in their cubicles. The factory tests shall be in accordance with IEEE C37.09 and shall include the following tests:
   a. Design Tests
   b. Production Tests
   c. Conformance Tests: These tests shall also include testing as required in ANSI C37.55, C37.57 and NEMA C37.54.
2. Furnish four (4) copies of certified manufacturer's factory test reports to the COR prior to shipment of the switchgear to ensure that the switchgear has been successfully tested as specified.
3. The Government shall have an option to witness the factory tests. All expenses of the Government Representative's trips to witness the testing will be paid by the Government. Notify the VA Central Office

through the COR not less than 30 days prior to making tests at the factory.

B. Field Testing:
   1. Field tests shall be in accordance with IEEE C37.09 and shall include the following:
      a. Tests after Delivery
      b. Field Tests

**1.4 SUBMITTALS**

A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

B. Shop Drawings:
   1. Shop drawings shall not be submitted until the Electrical System Protective Device Study has been submitted and approved.
   2. Provide detailed drawings with sufficient information, clearly presented, to determine compliance with drawings and specifications.
   3. Prior to fabrication of switchgear, submit four copies of the following data for approval:
      a. Complete electrical ratings
      b. Circuit breaker sizes
      c. Interrupting ratings
      d. Safety features
      e. Accessories and nameplate data
      f. One line diagram of the primary distribution system.
      g. Elementary and interconnection wiring diagrams.
      h. Technical data for each component.
      i. Dimensioned exterior views of the switchgear.
      j. Dimensioned section views of the switchgear.
      k. Floor plan of the switchgear.
      l. Foundation plan for the switchgear.
      m. Provisions and required locations for external conduit and wiring entrances.
      n. Dimensions and approximate design weights.
   4. Obtain and submit written approval from the local power company, that the equipment and material interface with the customer meets with their requirements and approval.

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

a. Include complete interconnection diagrams that show all components of the switchgear line-up.
b. Include complete diagrams of the internal wiring for each of the items of equipment.
c. The diagrams shall identify the terminals to facilitate in the installation, maintenance and operation.
d. Approvals will be based on complete submissions of manuals together with shop drawings.

2. Two weeks prior to the project final inspection or the inspection of the applicable phase that includes switchgear installation, submit four copies of a final updated maintenance and operating manual to the COR. (Update the manual to include any information necessitated by shop drawing approval).

D. Test Reports:
1. Submit four copies of certified conformance test reports for approval. Reports shall include, but not be limited to, interrupting, short time, momentary, BIL, high potential, fault close, and endurance performance.
2. Submit four copies of the certified factory design and production test reports for approval.
3. Two weeks prior to the project final inspection or phase inspection, submit four copies of the certified field test reports and data sheets to the COR.

E. Certifications: Two weeks prior to the project final inspection or the inspection of the applicable phase that includes switchgear installation, submit four copies of the following certifications to the COR:
1. Certification by the manufacturer of the switchgear that the equipment has been properly installed, adjusted and tested.

**1.5 APPLICABLE PUBLICATIONS**

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

B. American Concrete Institute (ACI):
ACI 318-00.....Building Code Requirements for Structural Concrete

C. American National Standards Institute (ANSI):
C37.47-00.....High Voltage Current-Limiting Type Distribution Class Fuses and Fuse Disconnecting Switches

C37.55-89.....Switchgear-Metal-Clad Switchgear Assemblies-Conformance Test Procedures

C37.57-90.....Switchgear-Metal-Enclosed Interrupter Switchgear Assemblies Conformance Testing

C37.85-89.....Switchgear-Alternating-Current High-Voltage Power Vacuum Interrupters-Safety Requirements for X-Radiation Limits

C39.1-81.....Electrical Analog Indicating Instruments, Requirements for

D. Institute of Electrical and Electronics Engineers (IEEE):

C37.04-99.....Standard Rating Structure for AC High-Voltage Circuit Breakers

C37.09-99.....Standard Test Procedure for AC High-Voltage Power Circuit Breakers Rated on a Symmetrical Current Basis

C37.20.2-99.....Standard for Metal-Clad Switchgear

C37.48-97.....Guide for Application, Operation and Maintenance of High Voltage Fuses, Distribution Enclosed Single Pole Air Switches, Fuse Disconnection Switches and Accessories

C37.90-89.....Standard for Relays and Relay Systems Associated with Electric Power Apparatus

C57.13-93.....Standard Requirements for Instrument Transformers

E. National Electrical Manufacturers Association (NEMA):

C37.06.1-00.....Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis

C37.54-87.....Switchgear - Indoor Alternating Current High-Voltage Circuit Breakers Applied as Removable Elements in Metal-Enclosed Switchgear Assemblies - Conformance Test Procedures

LA 1-92.....Surge Arrestors

SG 4-00.....Alternating-Current High-Voltage Circuit Breakers

F. National Fire Protection Association (NFPA):

70-02.....National Electrical Code (NEC):

**PART 2-PRODUCTS**

**2.1 GENERAL REQUIREMENTS**

A. The switchgear shall be in accordance with NEMA SG-4, IEEE C37.20.2 and the National Electrical Code as minimum requirements, and shall be as shown on the drawings and as specified.

B. Indicating instruments shall be in accordance with ANSI C39.1

C. Relays and relay systems shall be in accordance with IEEE C37.90.

D. Instrument transformers shall be in accordance with IEEE C57.13.

E. The switchgear line-up shall be a complete, grounded, continuous-duty, integral assembly, metal clad, dead-front, dead-rear, self-supporting, tamperproof, weatherproof, outdoor type switchgear assembly with metal housing and a walk-in protected aisle. Incorporate devices shown on the drawings and everything required to fulfill the operational and other requirements shown on the drawings.

F. Ratings shall be not less than shown on the drawings. Short circuit ratings shall be not less than 500 MVA.

G. Switchgear shall conform to the arrangements and details of the drawings and space designed for installation.

H. Coordinate the components of the switchgear line-up electrically and mechanically.

I. Switchgear shall be designed to withstand the mechanical stresses caused by rough handling during shipment in addition to the electrical (short circuit) and mechanical stresses, which will occur during operation of the station.

J. Interlocking shall be provided as shown on the drawings and as required for the safety of personnel and safe operation of the equipment.

K. Switchgear shall be assembled, connected and wired at the factory so that only external circuit connections are required at the construction site. Split the structure only as required for shipping and installation. Circuit breakers and accessories shall be packaged and shipped separately. Packaging shall provide adequate protection against rough handling during shipment.

L. All non-current carrying parts shall be grounded per applicable articles of the National Electrical Code. Refer to Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS for additional requirements.

M. End sections of switch gear shall be designed and constructed to allow expansion of the bus and the addition of additional sections.

**2.2 HOUSING**

A. The equipment and structure shall have the following features:

1. Frames and enclosures:
   a. The assembly shall be braced with reinforcing gussets and jig welds as required to assure rectangular rigidity.
   b. The enclosure shall be steel, leveled and not less than the gauge required by NEMA and ANSI Standards.
   c. Die-pierce the holes for connecting adjacent structures to insure proper alignment and to allow for future additions.
   d. All bolts, nuts, and washers shall be cadmium-plated steel.
2. Cubicles:
   a. An individual cubicle shall be supplied for each circuit breaker and each future circuit breaker indicated. Cubicles shall also be provided for auxiliaries, revenue metering, and transitions as indicated on the drawings.
      1) Compartment each cubicle so that the circuit breaker, buses, and cable terminations are in separate compartments with steel partitions or barriers of approved and properly installed insulation.
      2) Each cubicle furnished with a circuit breaker (active or spare) shall be fully equipped as noted on drawings and specified below.
      3) Each cubicle noted as space for future circuit breaker shall be fully equipped for positioning and connecting the breakers. Provide all equipment required to implement the future breaker installation, except the relays and meters on the cubicle doors and the associated current transformers.
   b. The cubicles shall be fabricated by a single manufacturer and shall be coordinated for their installation.
   c. Conveniently locate test blocks within each cubicle for circuit breaker wiring connections.
3. Cubicle doors:
   a. The doors shall permit convenient removal and interchanging of the circuit breakers between cubicles. The doors shall be capable of a swing approaching 180 degrees and shall be provided with intermediate doorstops.
   b. Each door shall include suitable handles and padlocking provisions. Concealed or semi-concealed hinges shall be provided to attach the doors. Weld the hinges to the equipment structure and to the cubicle doors.

c. The following equipment shall be mounted on the door of circuit breaker cubicles:
   1) Draw out, induction type relays.
   2) A breaker control switch.
   3) Breaker-position-indicator lamps energized by the station battery.
   4) Indicating ammeters and voltmeters and associated selector switches.
   5) Install any additional items indicated on the drawings.

B. Walk-in Protected Enclosure:
1. Where indicated on the drawings, provide an outdoor, weatherproof, protected walk-in aisle enclosure, fabricated and coordinated with the switchgear to form an integral enclosure.
2. The entire length of the protected aisle shall be wide enough to permit two circuit breakers to pass side by side conveniently.
3. Adequate space shall be provided for convenient operation and maintenance of the batteries, battery charger, circuit breaker test panel, and the revenue metering equipment. The aisle area shall be not less than shown on the drawings.
4. The entire space within the enclosure shall be provided with a steel floor adequately reinforced to allow the circuit breakers to be interchanged and serviced without causing the floor to deflect. The entire floor shall be at the same level.
5. The roof of the enclosure shall slope to allow for adequate run-off of moisture.
6. The entire area between the floor and foundation, including feeder conduits, shall be enclosed by structural steel or steel sheets.
7. The enclosure shall include proper ventilation. All ventilation openings shall be provided with suitable filters and screens. Provide thermostatically controlled exhaust fan with CFM sufficient to limit the temperature rise to 10 degrees F above ambient. Thermostat shall close contacts at 32 degrees C (90 degrees F). Provide motor starter with H-O-A switch adjacent to the wall-mounted thermostat.
8. Enclosure doors:
   a. Locate a door wide enough to allow a circuit breaker to pass at each end of the protected aisle.
   b. The doors shall be safety type, steel with concealed or semi-concealed hinges for attachment. Weld the hinges to the equipment structure.

c. Provide the doors with panic hardware on the inside and grab handle on the exterior. A latch bolt controlled by a key cylinder shall lock the door from the outside. Key the cylinder as directed by the COR.

9. Equipment rear doors:
   a. Provide suitable weatherproof type doors on the rear of the switchgear enclosure for each cubicle. Attach the doors by concealed or semi-concealed hinges. Weld the hinges to the enclosure and to the cubicle doors. Provide each door with a three-point latching and locking assembly and provisions for padlocking.
   b. The doors shall be capable of a swing approaching 180 degrees and shall be provided with intermediate doorstops.
10. Cubicle heaters:
   a. Install a thermostatically controlled electric strip heater within each circuit breaker cubicle and cable termination compartment to limit excessive humidity during adverse weather conditions. Thermostat shall be set and marked with manufacturer’s recommended setting.
   b. Heater and associated control wiring shall be pre-wired at the factory. Properly fuse the wiring and protect to prevent terminal overheating.
11. Lighting:
   a. Provide 1200 mm (four-foot), two-lamp, ceiling mounted, fluorescent fixtures, 2400 mm (eight feet) on centers over the front aisle, with fixtures parallel to the switchgear. Lamps shall be T8-32 watts each with matching electronic ballasts. Fixtures shall be securely mounted (chains or wires are not allowed) and include wire guards to protect lamps in each fixture
   b. Install a 3-way switch at each enclosure entrance to control the aisle lighting.
   c. Emergency light: Provide a self-contained battery pack with charger and two headlights mounted on a shelf near the ceiling (at middle of enclosure). Battery shall have capacity to operate the headlights for two hours.
12. Receptacles: Provide one 2P, 3W, 20-amp duplex ground fault (GFI) receptacle for each three cubicles or fraction thereof. Space receptacles equidistant along the exterior wall of the aisle space. Install a separate 20-amp circuit for every three (3) receptacles.

13. All branch circuit wiring shall be installed in conduit and shall be not less than #12 AWG.

C. Finish:

1. All metal surfaces shall be thoroughly cleaned, phosphatized and factory primed prior to applying baked enamel or lacquer finish.
2. Outdoor Switchgear:
   a. Interior finish shall be light gray.
   b. The underside of the switchgear and enclosure shall be treated with corrosion resistant compounds, epoxy resin or rubberized sealing compound.

**2.3 BUS**

A. Bus Bars and Interconnections:

1. Provide either copper or aluminum buses, fully rated for the amperage shown on the drawings. All ground buses shall be copper.
2. All aluminum bus bar joints shall be made by employing belleville type conical washers under the nuts and over the plated flat steel washers that are against the bus to assure constant pressure. Factory welded bus connections are acceptable.
3. Fully insulate and totally enclose the buses within the bus compartment of the switchgear cubicle.
4. Mount the buses on appropriately spaced insulators and brace to withstand the available short circuit currents.
5. The bus and bus compartment shall be designed so that the acceptable NEMA Standard temperature rises are not exceeded.
6. Install a ground bus the full length of the switchgear assembly. Bus size shall be 50 mm by 6 mm (2-inches by 1/4-inches).

B. Insulation: The insulation shall be a high flame-retardant, self extinguishing, high track-resistant material that complies with the NEMA Standard 65 degree C temperature rise.

C. Control Bus: Extend the control buses to all of the circuit breaker cubicles including spare and spaces for future circuit breakers.

D. End sections of switch gear shall be designed and constructed to allow expansion of the buses and the addition of additional sections. Bus shall have bolt holes for extension of the bus pre drilled. Ends of bus shall be insulated.

**2.4 CIRCUIT BREAKERS**

A. Breakers that have the same ratings shall be interchangeable with other breakers in that line-up.

B. The circuit breakers shall be in accordance with IEEE C37.04, NEMA C37.06.1 and NEMA SG-4. Breakers shall have the following features:
   1. Draw out vacuum interrupter type.
      a. Vacuum:
         1) Three independent sealed high vacuum interrupters.
         2) Protect the interrupter contacts from moisture and contaminated atmospheres.
         3) Readily accessible contact wear indicator for each interrupter.
         4) Provisions for slow closing (testing).
         5) Breaker total interrupting time of 3 cycles.
         6) Maintenance free interrupter.
         7) Contact surfaces to be of special alloys (such as copper chrome) to reduce effect of chopping.
         8) Provide each phase of each breaker with appropriate surge arrester for application voltage. Select surge arresters to minimize risk of damage to external electrical and electronic equipment.
         9) Vacuum interrupters shall meet the safety requirements of ANSI C37.85.
   2. Operating mechanism:
      a. The mechanism shall operate in a quick-make, quick-break manner and shall be charged by a small universal motor to provide stored-energy for breaker operation. Breaker tripping, closing, and indicating lamps shall be DC operated.
      b. The speed of the contacts during the operation shall be independent of the control voltage and the operator's movements.
      c. Equip the mechanism for manual opening and closing of the contacts during loss of normal control power and provide capability for slow manual operation during inspection of the contact wiping action.
   3. Drawout rails:
      a. Design the rails to guide the breakers to their disconnected, test, and connected positions. Provide a positive stop at each of the positions by a levering mechanism.
      b. The breaker shall maintain contact with ground in all positions through flexible connections and ground shoes.
      c. Make provisions for padlocking the breaker in the test and disconnected position.

4. Power line and load disconnecting contact fingers and springs:
   a. The contact fingers shall be silver-plated, full-floating, self-aligning, self-coupling, and designed for cleaning action during engaging and disengaging movements.
   b. Provide adequate flexibility between stationary and movable components to assure proper meeting of the contact fingers, while also providing adequate pressure on the contact surfaces.
   c. Mount the contacts on the breaker so that they can be conveniently inspected.
5. The stationary contacts for the line and load breaker contact fingers shall be isolated from the breaker compartment by shutters when the breaker is removed from the connected position.
6. The control and auxiliary contacts of the breaker shall be silver plated, multi-contact, self-coupling, plug and socket type. The contacts shall connect the circuits through terminal blocks that shall be conveniently mounted on the breaker for visual inspection.
7. Mechanical interlocks:
   a. Shall prevent the breaker from movement, except when the breaker contacts are in the open position.
   b. Shall prevent the breaker from closing the contacts while in the connected position, except when the power line and load disconnecting contacts are completely connected.

C. The interrupting ratings of the breakers shall be not less than 500 MVA.

**2.5 CURRENT TRANSFORMERS**

A. Provide encapsulated type current transformers or approved equal. The transformers shall have a mechanical and one-second thermal rating in RMS amperes of not less than the momentary and interrupting rating of the breaker at rated voltage.

B. Provide transformer ratios as shown on the drawings. Accuracies shall be coordinated with the associated relays and meters by the switchgear manufacturer to assure proper operation at the selected pick up and operating current ratings.

**2.6 POTENTIAL TRANSFORMERS**

A. The potential transformers shall be encapsulated, drawout, disconnecting type and shall be properly protected by primary current-limiting fuses.

B. When the transformers are withdrawn from the compartment the primary terminals shall be grounded.

C. The transformer ratios and accuracies shall be coordinated with the associated relays and meters by the switchgear manufacturer.

**2.7 CONTROL POWER TRANSFORMERS**

A. The control power transformers shall be encapsulated, drawout, disconnecting type and shall be properly protected by primary current-limiting fuses.

B. The ratings of the transformer shall be as indicated on the drawings.

C. Refer to the drawings for rating and capacity of the circuit breaker equipped panelboard served by the control power transformer.

D. Equip the control power transformer compartment door with indicating lights and nameplates to indicate when the control power is energized.

E. Dual Control Power Supplies:

1. For each of the incoming feeders, provide a separate control power transformer.
2. An automatic transfer switch shall transfer the secondary connected load as follows:
   a. While the preferred incoming feeder is energized, the load shall be connected to the transformer energized by the feeder.
   b. While the preferred incoming feeder is de-energized and the other incoming feeder is energized, the load shall be transferred to the energized incoming feeder.

**2.8 BATTERY SYSTEM**

A. Batteries:

1. Provide high discharge rate type nickel-cadmium batteries. Battery voltage shall be 125 volts nominal. Calculate the battery capacity based on the lowest ambient temperature in the room where it is to be installed. Include a safety margin of 50 percent for reserve capacity.
   a. Provide sufficient battery capacity to carry all continuous loads (lamps, relays, etc.) for 8 hours and then perform the greater of the following duties, with the charger de-energized.
      1) Trip all circuit breakers simultaneously or,
      2) Close the largest breaker in a line-up of four or less breakers, or close the two largest breakers simultaneously in a line-up of more than four breakers. Breaker closing current shall include both the spring release coil current and the starting current of the spring charging motor.
2. Each battery cell shall have electrolyte minimum and maximum level indicators, and flip top flame arrester vent cap.
3. Provide battery connector covers for protection against external short circuits.

4. Provide steel battery racks with an alkali resistant finish.
5. In seismic areas, batteries shall be secured to the battery rack to prevent overturning during a seismic event. Battery rack shall also be secured to the floor.

B. Battery Charger:
1. Provide a charger of the full wave rectifier type utilizing silicon controlled rectifiers as the power-control elements. Construction shall be modular with plug-in control units for easy replacement.
2. The charger shall maintain 1/2 of one percent voltage regulation from no load to full load for line voltage variation of 10 percent, and frequency variation of 3 Hz from 60 Hz.
3. The charger shall maintain a nominal float voltage of 1.4 vpc, and a nominal equalizing voltage of 1.5 vpc.
4. The charger shall be capable of continuous operation in an ambient temperature of 40 degrees C (104 degrees F) without derating. The charger shall be installed in a convection cooled NEMA Type I ventilated enclosure. The housing is to have a hinged front door with all equipment accessible from the front.
5. Provide both AC and DC transient protection. Charger shall be able to recharge a fully discharged battery without tripping AC protective devices. AC circuit breaker shall not trip under any DC load condition, including short circuit on output terminals.
6. The charger shall be capable of supplying the following demand simultaneously:
   a. Recharging a fully discharged battery in 12 hours.
   b. Supervisory panel and control panel.
   c. Steady loads (indicating lamps, relays, etc.).
7. The charger shall have fused AC input and DC output protection.
8. The charger shall not discharge the batteries when AC power fails.
9. The charger shall have the following accessories:
   a. On-off control switch with pilot light.
   b. AC power failure alarm light.
   c. High DC voltage alarm light.
   d. Low DC voltage alarm light.
   e. Ground detection switch and alarm light.
   f. DC ammeter - 2 percent accuracy.
   g. DC voltmeter - 2 percent accuracy: Float/equalize voltage marked in red on voltmeter.
   h. Provisions for activation of remote annunciation of trouble for the above conditions.

**2.9 OTHER EQUIPMENT**

A. Cable Terminations:
   1. Cable terminations shall conform to the requirements in Section 26 05 13, MEDIUM-VOLTAGE CABLES.
   2. Coordinate cable terminations with the switchgear being furnished.

B. High Voltage Lightning Arresters:
   1. Lightning arresters shall be valve type with wet process porcelain insulators. Supports that hold the porcelain in compression shall be rustproof steel. Arresters shall be in accordance with NEMA LA 1.
   2. Provide each ungrounded conductor of each incoming circuit with an arrester.
   3. Unless the class of the arrester is specifically shown on the drawings, the switchgear manufacturer shall provide the class arrester required to protect the equipment. Provide a suitable dielectric barrier to isolate the arresters from the switchgear compartment.

**2.10 AUXILIARIES**

A. Install all additional components required for proper operation of the switchgear.

**2.11 SWITCHGEAR WIRES**

A. Switchgear control wires shall not be less than No. 14 AWG copper 600 volt, Class B, Stranded SIS. Install wiring complete at the factory, adequately bundled and protected. All conductors across hinges, and all conductors for interconnection between shipping units shall be Class C stranded. Conductors shall be sized in accordance with the NEC. Provide separate control circuit fuses in each breaker compartment and locate for ease of access and maintenance.

**2.12 TEST CABINET**

A. The test cabinet shall facilitate the convenient testing of the power circuit breakers and shall be installed where indicated on the drawings.

**2.13 IDENTIFICATION SIGNS AND MIMIC BUS**

A. Permanently identify each cubicle of the switchgear assembly by a sign which clearly indicates the enclosed equipment or breaker designation.

B. Provide signs of laminated black phenolic resin with a white core and engraved lettering of not less than 6 mm (1/4-inch) high.

C. Provide an approved mimic bus on the front of each switchgear assembly, either factory painted, plastic, or metal strips. Secure strips in place

by plated screws. Strips shall be secured flat and free of waves. Plastic tape shall not be used. Use symbols similar to a one line diagram (refer to drawings).

**2.14 ONE LINE DIAGRAM**

A. An as-built one line diagram, clearly identified, shall be laminated or mounted under plexiglas, installed in a frame and mounted on a wall adjacent to the switchgear assembly.

B. Deliver an additional four spare copies (same as at the switchgear unit) of the one line diagram to the COR.

**2.15 VOLTAGE WARNING SIGN**

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

**2.16 ACCESSORIES**

A. Furnish all accessories to the COR as recommended by the switchgear assembly manufacturer to facilitate the convenient maintenance and operation of the assembly.

**2.17 AS-LEFT RELAY SETTING AND FUSE RATINGS**

A. Relay settings of the high voltage switchgear breakers will be provided to the contractor by the substation design engineer.

B. The settings shall be calibrated and set in the field by an authorized representative of the switchgear manufacturer.

C. Post a durable copy of the "as-left" relay settings and fuse ratings in a convenient location within the switchgear assembly. Deliver four additional copies of the settings and fuse ratings to the COR. Furnish this information prior to the activation of the switchgear.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. Install the switchgear in accordance with the NEC, manufacturer's recommendations and instructions.

B. Anchor the individual cubicles to the steel flooring by bolts, not less than 13 mm (1/2-inch) diameter. Furnish 100 mm (4-inch) channel iron sills for new concrete floors and level flush into the floor.

**3.2 FOUNDATION**

A. The concrete shall have 21 Mpa (3000 psi) compressive strength in a minimum of 28 days, and comply with the American Concrete Institute Publication 318, "Building Code Requirements for Structural Concrete".

B. Locate the top of the foundation 150 mm (six inches) above the adjacent grade, unless otherwise indicated on the drawings.

C. Grade the adjacent terrain away from the switchgear to allow water to run away from the structure.

D. Use cadmium plated bolts, nuts and washers, not less than 13 mm (1/2-inch) in diameter, to fasten the structure to the foundation.

**3.3 TECHNICAL SERVICES DURING INSTALLATION AND FIELD TESTING**

A. An authorized representative of the switchgear manufacturer shall technically supervise and participate during all of the field adjustments and tests. Major adjustments and field tests shall be witnessed by the COR. This shall be provided by and arranged for by the Contractor.

B. Perform all tests listed in NETA "Acceptance Testing Specifications for Electrical Power Distribution Equipment" (copyright 2007) sections 7.5.3 and 7.6.3, 7.10, 7.18, and 7.22.3.

C. Prior to the final inspection for acceptance, the COR shall witness all or part of the testing of the equipment at his option to assure the proper operation of the individual components and confirm proper operation/coordination with downstream equipment and eliminate any electrical and mechanical defects.

   1. Notify the COR a minimum of ten (10) working days prior to scheduling tests.
   2. When any defects are detected, make corrections and repeat all tests as requested by the COR, at no additional cost to the Government.

**3.4 INSTRUCTIONS AND FINAL INSPECTION**

A. A complete set of operating instructions for the switchgear shall be laminated or mounted under plexiglas and installed in a frame on the wall of switchgear assembly.

B. Conduct a final inspection, in the presence of a VA representative, to assure that the switchgear operates properly in all respects.

C. Furnish the services of a factory-trained engineer for two, 4-hour training periods for instructing personnel in the maintenance and operation of the equipment, on the dates requested by the COR.

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