

## **SECTION 26 1316 – MEDIUM-VOLTAGE FUSIBLE INTERRUPTER SWITCHGEAR**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:

1. This Section specifies the medium voltage switchgear and fusing for buildings and structures.
2. Provide all labor, materials, and equipment as necessary to complete all work as indicated on the drawings, and as specified herein for a complete operating system.
3. Furnish, install, and connect complete for operation new metal-enclosed primary switch unit and make all necessary wiring connections to the primary feeders as required by the drawings and for a complete working job.
4. Medium-voltage switchgear shall include the following items at a minimum:
  - a. Medium voltage fusible interrupter switchgear
  - b. Medium voltage fuses

#### **1.3 SUBMITTALS**

- A. Shop Drawings

1. Medium-voltage switchgear
2. Medium-voltage fuses

#### **1.4 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NFPA 70, “National Electrical Code”
- C. The switchgear shall conform to the following:

1. ANSI C37.20
2. IEEE Standard 27
3. NEMA SG-5
4. National Electrical Code Article 710-21(e)

D. Guarantee

1. Furnish full parts and labor warranty to cover the switchgear for two years from shipment

1.5 MATERIAL TURNED OVER TO OWNER

A. Products Supplied But Not Installed Under This Section

1. Provide 3 spare primary fuses for each size used in the primary interrupter switches.
2. Portable control station with 50 ft. cord.
3. Test accessory.
4. Maintenance cable (nine pin).
5. 8'-0" jumper cable, two complete sets of three.
6. Two jumper storage bags.
7. Shotgun stick.
8. Shotgun stick storage bag.
9. Voltage tester with audio/visual signals.
10. Pentahead socket.
11. Universal Pole 8'-0" long.
12. Grappler handling tool.
13. Large clamp.
14. Any other miscellaneous components and accessories.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: S&C Electric.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. S&C Electric.
  2. Eaton Corporation; Cutler-Hammer Products.
  3. Square D; Schneider Electric.
  4. Powercon Corporation.

## 2.2 GENERAL

- A. Medium voltage primary switch unit shall consist of two 15 KV fused primary selector switches with automatic throwover for the incoming feeders and 15 KV fused primary switch and shall be furnished complete with channels.
- B. Medium voltage substation primary feeders switches unit shall consist of two 15 KV fused primary selector switches manually operated for the two feeders and 15 KV primary termination compartment, as indicated on drawings, and shall be furnished complete with channels.
- C. The ratings for the integrated switchgear assembly shall be as follows:
- |    |   |        |
|----|---|--------|
| 1. | kV, Nominal   | 13.2   |
| 2. | kV, Maximum Design                                      | 17.0   |
| 3. | kV, BIL   | 95     |
| 4. | Main Bus Continuous, Amperes                            | 600    |
| 5. | Short-Circuit Ratings                                   |        |
|    | a. Amperes, RMS Symmetrical                             | 25,000 |
|    | b. MVA Three-Phase Symmetrical at Rated Nominal Voltage | 600    |
| 6. | Duty-Cycle Fault-Closing Amperes, RMS Asymmetrical      | 40,000 |
- D. The momentary and duty-cycle fault-closing ratings of switches, momentary rating of bus, and interrupting ratings of fuses shall equal or exceed the short-circuit ratings of the metal-enclosed switchgear.
- E. The interrupter switches shall have two-time duty-cycle fault-closing integrated switchgear assembly. These ratings define the ability to close the interrupter switch, either alone (unfused) or in combination with the appropriate power fuse, against a three-phase fault with asymmetrical current in at least one phase equal to the rated value, with the switch remaining operable and able to carry and interrupt rated current. Tests substantiating these ratings shall be performed at maximum design voltage applied for at least ten cycles and certified copies of tests submitted for record information.
- F. The switch unit shall be arranged to provide control of switches from the front as indicated on the drawing. Unit shall be free standing, consisting of cubicles arranged for bolting together on concrete pad. Cubicles shall be welded, reinforced sheet steel enclosures with hinged doors. Complete unit shall be rustproofed and painted two coats.
- G. The dimensions of the unit as indicated on the drawing are approximate. These shall be varied to suit the particular equipment furnished and such that overall dimensions of the completely assembled unit shall suit the space, subject to the approval of the Engineers. Complete shop drawings shall be submitted to the Engineers before fabrication.
- H. The main buss shall be non-insulated flat copper bar of a minimum 56%IACS conductivity, mounted on track resistant Cycloaliphatic bus supports. The ground bus shall consist of copper bar CA11-, square edge, hard temper per ASTM B187. The contact surface for each bus connection shall be silver plated and tightly bolted to insure maximum conductivity.

- I. Primary switch unit shall have a ground bus extending through each compartment for its entire length. Provide connections to ground system as indicated on drawing.
- J. The bracing supporting the switches in the enclosure shall be of sufficient strength to permit laying the unit on its side. Also, the crating shall be arranged to permit laying the unit on its side for shipping.
- K. The primary switch unit shall be completely wired, assembled, and operationally checked at the factory.

### 2.3 SELECTOR SWITCHES

- A. Primary selector switches shall be fused, heavy duty, quick-make quick-break, 15 KV, 600 ampere, 3 pole, 95 KV BIL, with a minimum load interrupting rating of 600 amperes.
- B. Primary switch shall be provided with three 15 KV fuses sized to properly protect the unit substation transformer. Fuses shall be power type with condensers and minimum interrupting rating of 600 MVA. Fuses shall be S & C, General Electric, Bussmann, or Gould Shawmat.
- C. Each primary selector switch shall have diamond mesh expanded metal inner door with an engraved plate reading - WARNING - OPEN SWITCH BLADES ARE ENERGIZED -.
- D. Primary selector switch units shall each be provided with lugs inside enclosure for termination of 2/0 AWG or 350 KCMIL as necessary with outdoor type Class 1 terminations, 15 KV single conductor cable entering the compartment.
- E. Primary switches shall have mechanically interlocked doors to prevent access to switches or fuses when the switch is closed.

### 2.4 COMMON BUS PRIMARY-SELECTIVE AUTOMATIC THROWOVER

- A. The automatic throwover unit shall automatically close and open the primary selector switches by means of three 7.62KV-120 volt control transformers with primary fuses on each incoming line, and necessary motor drives, limit switches, relays, and accessories. The automatic throwover unit shall include the following features:
  - 1. Provisions for disconnecting the motor operators from the primary selector switches for manual operation of the switches, and disconnecting mechanism to allow testing automatic transfer equipment without operating 600 amp, 15 KV selector switch.
  - 2. Three phase sensing.
  - 3. Interlock to prevent closing both primary selector switches simultaneously, except for manual operation.

4. Three current transformers and necessary relays shall be provided with necessary controls to prevent transfer in the event of a phase-to-phase bus fault.
  5. Source selector to permit random selection of either incoming line as preferred or alternate source.
  6. Field selection of Automatic Hold Return to select automatic return to a preferred source or holding on the alternate source after the initial automatic transfer operation.
  7. Field selection of open transition or closed transition on automatic retransfer.
  8. Field selection of Automatic-Manual operation.
  9. Source-voltage indicating lamps of the push-to-test type that shall indicate presence of correct voltage on each high-voltage source.
  10. A field-adjustable time delay between loss of voltage and initiation of automatic switching to confirm that loss of voltage on either source is not transient. The timer range shall be from 1/4 to 10 seconds.
  11. A field-adjustable time delay between return of voltage and initiation of retransfer switching to confirm that return of voltage on either source is not temporary. The timer range shall be from 1/2 to 15 minutes.
  12. An indicating lamp of the push-to-test type which shall indicate that all switch operators are coupled to their respective interrupter switches and are in the correct positions; that all doors providing access to interrupter switches powered by stored-energy switch operators are closed and latched; that the source-transfer control is in the automatic mode; and that all control circuitry is properly connected for automatic transfer.
  13. Pushbutton test switches shall be provided to simulate loss of voltage on either source and to allow convenient field testing of the entire source-transfer scheme.
  14. Controls located in a removable drawer and a low voltage compartment completely isolated from high voltage circuits.
  15. Switch operating mechanism shall be removable for repairs and capable of decoupling without access to high-voltage compartment. It shall be in a grounded compartment.
  16. Current transformer and relays for ground fault blocking to prevent transfer if fault occurs in this unit.
- B. Primary automatic throwover switch shall be S & C utilizing S & C Micro-AT Source-Transfer Control.

## 2.5 PRIMARY SWITCH – ATS - EM

- A. Primary switch shall be fused, heavy duty, quick-make quick-break, 15 KV, 600 ampere, 3 pole, 95 KV BIL, with a minimum load interrupting rating of 600 amperes.
- B. Primary switch shall be provided with three 15 KV fuses sized to properly protect the unit substation transformer. Fuses shall be power type with condensers and minimum interrupting rating of 600 MVA. Fuses shall be S & C, General Electric, Bussmann, or Gould Shawmut.
- C. Switches shall be provided with lugs for No. 2/0 AWG, 15 KV cable connection and sufficient space for termination of cables and terminators.
- D. Primary switches shall have mechanically interlocked doors to prevent access to switches or fuses when the switch is closed.

## 2.6 OUTDOOR SWITCHGEAR

- A. Outdoor Finish
  - 1. The enclosure finish shall conform to or exceed the applicable requirements of ANSI C57.12.28.
  - 2. During fabrication, the areas of structural parts which may later become inaccessible, such as folded edges and overlapping members, shall be given an iron-oxide zinc-chromate anticorrosion primer to ensure that all surfaces are protected.
  - 3. Full coverage at joints and blind areas shall be achieved by processing enclosures independently of components such as doors and roofs before assembly into the unitized structures.
  - 4. To remove oils and dirt, to form a chemically and anodically neutral conversion corrosion, all surfaces shall undergo a thorough pretreatment process comprised of a fully automated system of cleaning, rinsing, phosphatizing, sealing, drying, and cooling before any protective coatings are applied. By utilizing an automated pretreatment process, the enclosure shall receive a highly consistent thorough treatment, eliminating fluctuations in reaction time, reaction temperature, and chemical concentrations.
  - 5. After pretreatment, protective coatings shall be applied that shall help resist corrosion and protect the steel enclosure. To establish the capability to resist corrosion and protect the enclosure, representative test specimens coated by the enclosure manufacturer's finishing system shall satisfactorily pass the following tests:
    - a. 4000 hours of exposure to salt-spray testing per ASTM B 117 with:
      - i. Under-film corrosion not to extend more than 1/32 in. from the scribe, as evaluated per ASTM D 1654, Procedure A, Method 2 (scraping); and
      - ii. Loss of adhesion from bare metal not to extend more than 1/8 in. from the scribe.

- b. 1000 hours of humidity testing per ASTM D 4585, with no blistering as evaluated per ASTM D 714.
  - c. 500 hours of ultraviolet-accelerated weathering testing per ASTM G 53 using lamp UVB-313, with no chalking as evaluated per ASTM D 659, and no more than a 10% reduction of paint gloss as evaluated per ASTM D 523.
  - d. Crosshatch-adhesion testing per ASTM D 3359 Method B, with no loss of paint.
  - e. 160-inch-pound impact, followed by adhesion testing per ASTM D 2794, with no paint chipping or cracking.
  - f. 3000 cycles of abrasion testing per ASTM 4060, with no penetration to the substrate.
  - g. Certified test abstracts substantiating the above capabilities shall be furnished upon request.
6. A heavy coat of insulating “no-drip” compound shall be applied to the inside surface of the roof structure to prevent condensation of moisture thereon.
  7. After the enclosures are completely assembled and the components (switches, fuses, bus, etc.) are installed, the finish shall be inspected for scuffs and scratches. Blemishes shall be touched up to restore the protective integrity of the finish.
  8. Touch-up materials—with complete instructions—shall be included with each shipment of metal-enclosed switchgear, for touch-up in the field.
  9. The finish shall be light gray, satisfying the requirements of ANSI Standard Z55.1 for No. 61. TGIC polyester powder applied electro statically through air. Following paint application, parts shall be baked to produce a hard durable finish. The average thickness of the paint film shall be 2.0 mils. Paint film shall be uniform in color and free from blisters, sags, flaking and peeling.
  10. Adequacy of paint finish to inhibit the buildup of rust on ferrous metal materials shall be tested and evaluated per paragraphs 5.2.8.1-7 of ANSI C37.20.2-1987. Salt spray withstand tests in accordance with ASTM #D-1654 and #B-117 shall be periodically performed on a sample to confirm conformance with the corrosion resistance standard of at least 2500 hours minimum (outdoor equipment).

B. Outdoor Features

1. Enclosure Ventilation
  - a. Ventilation openings shall be provided at the top and bottom on the front and rear of each bay. Ventilation openings on the front of arc-resistant switchgear shall be provided at the top only.
  - b. Vents shall be rain-resistant and corrosion-resistant.
  - c. Each vent shall have an inside screen and baffle to exclude insects and to protect against insertion of foreign objects.
  - d. In consideration of exceptionally high concentrations of airborne dust, externally accessible glass-fiber filters shall be provided.
2. Lifting eyes shall be removable. Sockets for lifting eyes shall be blind-tapped.

3. Gasketing and Sealing
  - a. Door openings and openings for hinged bolted panels (and bolted panels providing access to low-voltage components) shall have resilient compression gasketing to prevent water from entering the enclosure.
  - b. Gasket seals shall be provided at the top and side edges of adjoining bays to prevent water entry between the double walls.
  - c. The top and both sides of bus openings between bays shall be covered with channel gaskets as an additional protection against entrance of water, or external labyrinthine metal rainshields shall be provided over enclosure roof flanges between adjacent bays.
  - d. Roofs shall be weather-sealed in place with a suitable sealant.
4. Space Heaters
  - a. Space heaters 120V AC with sheaths of high-temperature chrome steel shall be provided to maintain air circulation inside the enclosure.
  - b. There shall be a space heater in each bay.
  - c. Space heaters shall be wired to generator load center.
  - d. A low-voltage circuit breaker shall be provided in the strip heater circuit.

## 2.7 METERING SECTION

- A. Provide Metering Section with provisions for utility supplied PT's and CT's.

## 2.8 SUBSTATION PRIMARY FEEDERS SWITCHES

- A. Primary feeder switches shall be **fused**, heavy duty, quick-make quick-break, 15 KV, 600 ampere, 3 pole, 95 KV BIL, with a minimum load interrupting rating of 600 amperes.
- B. **Primary feeder switches shall be provided with three 15 KV fuses sized to properly protect the unit substation transformer. Fuses shall be power type with condensers and minimum interrupting rating of 600 MVA. Fuses shall be S & C, General Electric, Bussmann, or Gould Shawmut.**
- C. Each primary feeder switch shall have diamond mesh expanded metal inner door with an engraved plate reading - WARNING - OPEN SWITCH BLADES ARE ENERGIZED -.
- D. Primary switch units shall each be provided with lugs inside enclosure for termination of 2/0 AWG or 350 KCMIL as necessary with outdoor type Class 1 terminations, 15 KV single conductor cable entering the compartment.
- E. Incoming termination compartment shall be provided with lugs inside enclosure for termination of 2/0 AWG or 350 KCMIL as necessary with outdoor type Class 1 terminations, 15 KV single conductor cable entering the compartment.



## 2.9 SOURCE QUALITY CONTROL

- A. Before shipment of equipment, perform the following tests and prepare test reports:
  - 1. Production tests on completed switchgear assembly according to IEEE C37.20.2.
- B. Assemble switchgear and equipment in manufacturer's plant and perform the following:
  - 1. Functional tests of all features and control devices.
  - 2. Functional test of all trip mechanisms.
- C. Prepare equipment for shipment.
  - 1. Provide suitable crating, blocking, and supports so equipment will withstand expected domestic shipping and handling shocks and vibration.
  - 2. Weatherproof equipment for shipment. Close connection openings to prevent entrance of foreign material during shipment and storage.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive switchgear for compliance with requirements for installation tolerances, required clearances, and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Anchor switchgear assembly to 4-inch (100-mm), channel-iron sill embedded in concrete base and attach by bolting.
  - 1. Sills: Select to suit switchgear; level and grout flush into concrete base.
  - 2. Concrete Bases as indicated on drawings.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchgear units and components.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
  - 1. Provide engraved plastic-laminate signs, per Section 260553, "Identification for Electrical Systems", located on the front of each component, indicating the lines of information as follows:
    - a. Incoming line Section
      - 1) Designation (e.g., "Incoming line 1").
      - 2) Incoming line electrical characteristics (e.g., 13.2kV, 3PH, 3W, grounded").
    - b. Feeder Section

- 1) Designation (e.g., “ATS-EM”).
- 2) Load served (e.g., “Load served: Substation A - LBS-1 ”).

B. Diagram and Instructions:

1. Frame under clear acrylic plastic on front of switchgear.
  - a. Operating Instructions: Printed basic instructions for switchgear, including control and key-interlock sequences and emergency procedures.
  - b. System Power Riser Diagrams: Depict power sources, feeders, distribution components, and major loads.
2. Storage for Maintenance: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.

C. Phasing shall be marked at each termination location of 15KV cable in switchgear using 1 inch high, white, adhesive labels. Marking to be X, Y, Z reading left to right, or front to back while facing front of switchgear.

### 3.4 CONNECTIONS

- A. Cable terminations at switchgear are specified in Division 26 Section "Medium-Voltage Cables."
- B. Tighten bus joints, electrical connectors, and terminals according to manufacturer's published torque-tightening values.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Sections "Low-Voltage Electrical Power Conductors and Cables" and "Medium-Voltage Cables."

### 3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  1. Test insulation resistance for each switchgear bus, component, connecting supply, feeder, and control circuit.
  2. Test continuity of each circuit.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
  1. Inspect switchgear, wiring, components, connections, and equipment installation. Test and adjust components and equipment.
  2. Assist in field testing of equipment.
  3. Report results in writing.
- C. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

- D. Perform the following field tests and inspections and prepare test reports:
  - 1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for each of the following NETA categories:
    - a. Switchgear.
    - b. Source-Transfer Controls.
    - c. Instrument transformers.
    - d. Surge arresters.
- E. Remove and replace malfunctioning units and retest as specified above.

### 3.6 CLEANING

- A. On completion of installation, inspect interior and exterior of switchgear. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair damaged finishes.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchgear.

END OF SECTION 26 1316