

SECTION 26 13 16

MEDIUM VOLTAGE FUSED SWITCH INTERRUPTER

PART 1 - GENERAL

1.1 SUMMARY

- A. The scope of this section includes providing and assembling materials and equipment for the dead-front, medium voltage (4160 Volt) switchgear sections and fuses of the Unit Substations.
- B. Reference to Manufacturer in this section is to be considered the switchgear manufacturer.
- C. Related Work: Consult below listed Sections, determine the extent and character of related scope and coordinate work specified herein.

SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

SECTION 26 05 48 – VIBRATION CONTROLS FOR ELECTRICAL SYSTEMS

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

SECTION 26 12 16 – MEDIUM (MV) VOLTAGE DRY-TYPE TRANSFORMERS

SECTION 26 13 16 – MEDIUM (MV) VOLTAGE FUSIBLE INTERRUPTER
SWITCHGEAR

1.2 REFERENCES

- A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:
 - 1. ANSI / IEEE C37.20.4 (19__)- Standard for Indoor AC Medium-Voltage Switches used in Metal-Enclosed Switchgear.
 - 2. ANSI / IEEE 48 (19__)- Standard Test Procedures and Requirements for High-Voltage Alternating-Current Cable Termination.
 - 3. IEC 420 High-Voltage Alternating Current Switch-Fuse Combinations (Applicable sections to ensure proper coordination of the switch-fuse combination when fuses are utilized for opening the switch automatically) Test Duties 4 and 5.
 - 4. CAN/CSA C22.2 No. 31 Switchgear Assemblies.
 - 5. CAN/CSA C22.2 No. 193 High Voltage Full-Load Interrupter Switches.
 - 6. NFPA 70 – National Electrical Code (NEC)
 - 7. UL 486A - Wire Connectors and Soldering Lugs for use with Copper Conductors
 - 8. UL 489 - Molded- Case Circuit Breakers and Circuit Breaker Enclosures
 - 9. UL 891 - Dead-Front Electrical Switchboards

1.3 SUBMITTALS

- A. Submit the following items with bid proposal response:
 - 1. Shop drawings to include:
 - a. Front, plan and side view elevations with overall dimensions.

- b. Conduit entrance locations and requirements.
 - c. Single line & schematic diagrams.
 - d. Switchgear electrical characteristics including voltage, frame size and trip rating, and withstand ratings.
 - e. Fuse ratings, type, and model number
- B. Submit the following items within two business days of request by Owner's Representative:
1. Data/catalog cuts for each product and component specified herein, listing all physical and electrical characteristics and ratings indicating compliance with all listed standards for switchgear and fuses.
 2. Shop drawings which shall include:
 - a. Front, plan and side view elevations with overall dimensions.
 - b. Conduit entrance locations and requirements.
 - c. Size and number of bus bars per phase, neutral, and ground.
 - d. Line lug types and requirements.
 - e. Single line & schematic diagrams.
 - f. Electrical characteristics including voltage, frame size and trip rating, and withstand ratings.
 - g. Submit manufacturer's installation instructions.
- C. Submit the following items one week prior to delivery of the switchboard:
1. Complete Bill of Material listing all components.
 2. Submit Field Test reports.
 3. Nameplate legends.
 4. Anchorage details including details of vibration insulators installation. (provided by others).
 5. Submit seismic anchorage calculations prepared by a professional structural engineer registered in the State of Texas.
 6. Operations and maintenance manuals.
 7. Warranty
- D. Dimensions and configurations of switchgear shall conform to the space allocated on the Drawings. The Manufacturer shall submit a revised layout if equipment furnished varies in size from that shown on drawings for the Owner's Representative approval.
- E. Operation and Maintenance manuals submittals shall include the following:
1. A detailed explanation of the operation of the system
 2. Instructions for routine maintenance
 3. Pictorial parts list and part numbers
 4. Telephone numbers for the authorized parts and service distributors.
 5. Final testing reports
 6. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.4 QUALIFICATIONS

- A. The manufacturer of the switchgear shall be the same manufacturer of the major components within the switchgear and the manufacturer of the low voltage switchboards provided in Section 26 24 13.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- C. The equipment shall be seismic tested or qualified per local building code.
 - 1. The equipment and major components shall be suitable for and certified to meet all applicable seismic requirements of the International Building Code (IBC) for the applicable Site Classification.
 - 2. Guidelines for the installation consistent with the IBC requirements shall be provided by the equipment manufacturer and based upon testing of representative equipment. Equipment certification acceptance criteria shall be based upon the ability for the equipment to be returned to service immediately after a seismic event within the above requirements without the need for repairs.

1.5 QUALITY ASSURANCE

- A. All materials, equipment and parts comprising the units specified herein shall be new.
- B. Manufacturer shall pay for the services of a qualified testing agency to perform the specified factory tests of paragraph 3.3 FACTORY TESTS of this section. The Manufacturer shall notify the Owner's Representative at least five (5) working days in advance of performance of work requiring testing. The Manufacturer shall provide all material required for testing.
- C. Manufacturer shall pay for the services of a Manufacturer's technician to perform the specified field tests of paragraph 3.5 FACTORY TESTS of this section. The Manufacturer shall notify the Owner's Representative at least five (5) working days in advance of performance of work requiring testing. The Manufacturer shall provide all material required for testing.
- D. Qualifications: The testing agency(ies) shall be a member of International Electrical Testing Association and specializing in testing products specified in this section with minimum five years of documented experience.
- E. Manufacturer warranty for switchgear shall be for two years commencing of the date of successful energizing of equipment following completion of all required testing.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery: Switchgear components shall not be delivered to the site until protected storage space is available. Storage outdoors covered by rainproof material is not acceptable. Equipment damaged during shipment shall be replaced and returned to manufacturer at no additional cost to the Owner's Representative. Components shall be properly packaged in factory-fabricated containers and mounted on shipping skids.
- B. Storage: Store in a clean, dry, ventilated space free from temperature extremes. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and traffic. Provide heat where required to prevent condensation.
- C. Handling: Handle in accordance with NEMA PB2.1 and manufacturer's written instructions. Be careful to prevent internal component damage, breakage, denting and scoring. Damaged units shall not be installed. Replace damaged units and return equipment to manufacturer.

- D. Manufacturer's Technician to provide fuses to site at time of switchgear assembly and will maintain custody of fuses until installed and provide spare fuses to Owner's representative upon completion of testing.

1.7 WARRANTY

- A. Equipment and components offered under this Section shall be covered by a two (2) year parts and labor warranty for malfunctions resulting from defects in materials and workmanship.
- B. Manufacturer warranty for switchgear shall be for two years commencing of the date of successful energizing of equipment following completion of all required testing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, the following:
 - 1. Square D
 - 2. Eaton (Cutler-Hammer)
 - 3. General Electric Company; GE Energy Management - Electrical Distribution.
 - 4. Siemens

2.2 RATINGS

- A. Voltage ratings shall be as indicated on the drawings.

2.3 CONSTRUCTION

- A. The entire switchgear shall be of unit construction with all parts designed, manufactured, and assembled by a single manufacturer to assure coordination between all items.
- B. Switchgear shall have a switch compartment and may, and Manufacturer's option have cable connection/gutter compartment provided all compartments meet dimensional requirements of specification and drawings.
- C. The integrated fused switchgear assembly shall withstand the effects of closing, carrying and interrupting currents up to 65,000 amps short circuit rating.
- D. The design of all current carrying devices or parts of switchgears shall conform to the standard specified in the applicable UL standards Electrical Manufacturer's Association (NEMA) standards, except as these characteristics may be modified herein.
- E. The switchgear shall be floor mounted, self-supporting, dead-front and rear, front operated, front connected. The enclosure shall be of indoor construction and not exceed 90" in height.
- F. Switch compartment shall be close-coupled to the transformer provided in Section 26 12 16.
- G. All serviceable components shall be front accessible.
- H. Overall switchgear dimensions shall fit within the areas allotted on the drawings,
- I. Alignment with other sections (front or rear) will be selected by the Owner's representative. Manufacturer will submit preferred alignment in initial shop drawings.

- J. All switchgear sections shall be a minimum of 24" deep and shall be constructed of National Electrical Code (NEC) gage steel. All holes, supports, studs and openings shall be standardized to enable interchange of interior and front cover units. All sections shall be fabricated with right angle corners, plumb edges and surfaces. All switchgear sections shall line up evenly, front and rear.

2.4 BUS

- A. All bus bars shall be silver-plated copper. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane. Bus sizing shall be based on NEMA standard temperature rise criteria of 65°C over a 40°C ambient (outside the enclosure).
- B. Bus bars, connection bars and wiring on the back of the switchgear shall be arranged so that all accessibility is provided for cable connections from the front.
- C. Electrical clearance between parts of opposite polarity, and between live parts and ground, shall conform to the National Electrical Code (NEC).
- D. Ampere ratings for rectangular bus bars shall be in accordance with the temperature rise standard of NEMA and UL.
- E. All connections between bus bars shall be of a bolted-type. Clamps will not be accepted. All bus bars shall be accurately formed, and all holes shall be made in a manner that will permit bus bars and connections to be fitted into place without being forced.

2.5 WIRING/TERMINATIONS

- A. Cable entry shall be from the top.
- B. An anti-rotational mounting pad shall have provision for 1 single hole cable lug per phase.
- C. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the drawings.
- D. All wiring gutters shall extend the full length and depth of the switchgear.

2.6 PROTECTIVE DEVICES

- A. Provide current-limiting 400 Ampere fuses of type recommended by the Manufacturer. Fuses shall have a 65,000 amperes symmetrical interrupting capability at 5 kV. Provide three fuses per switch and three spare fuses. Replace fuses used in testing with new fuses upon completion of testing.

2.7 ACCESSORIES AND OTHER DEVICES

- A. Provide a grounding switch on the load side of the fuses to discharge any capacitive voltage in the feeder cable prior to gaining access to the fuse compartment. Switch shall be mechanically interlocked with the main grounding switch of the load interrupter switch.
- B. Provide one viewing port.
- C. Provide pad lock provisions for mechanism covers on the load interrupter switch and grounding switch mechanisms.

2.8 MISCELLANEOUS

A. Finish

1. All metal structural and unit parts shall be completely painted so that interior and exterior surfaces have a complete finish coat on and between them.
2. Enclosure shall be thoroughly cleaned, rinsed, pretreated with phosphatizing process followed by sealer rinses and rust inhibitor process and painting.
3. Paint shall be UL recognized acrylic, baked enamel ANSI-61 light gray
4. All non-painted steel parts shall be zinc plated.

B. Construction and installation shall meet local seismic code requirements.

PART 3 - EXECUTION

3.1 DELIVERY AND ASSEMBLY

- A. Manufacturer shall deliver all switchgear components to site or other location within 20 miles of the site as directed by the Owner's Representative.
- B. Switchgear components will be placed at the final placement location on the site by others under observation of the Manufacturer's technician.
- C. Switchgear shall be assembled at the final placement location by the Manufacturer's technician.

3.2 PREPARATION

- A. Provide anchorage details, coordinated with the switchgear mounting provision, prepared and stamped by a licensed engineer as stated in Part 1.
- B. Coordinate all requirements for termination of bus and conductors of the transformer provided in Section 26 12 16.

3.3 FACTORY TESTING

- A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.
 1. The switchgear shall be completely assembled, wired, adjusted, and tested at the factory.
 2. After assembly, the complete switchgear shall be tested for operation under simulated service conditions to ensure the accuracy of the wiring and the functioning of all equipment.
 3. The main circuits shall be given a dielectric test of 2200 volts for one (1) minute between live parts and ground, and between opposite polarities.
 4. The wiring and control circuits shall be given a dielectric test of 1500 volts for one (1) minute between live parts and ground.
- B. The manufacturer shall provide three (3) certified copies of factory test reports.

3.4 ASSEMBLY

- A. Install switchgears in accordance with manufacturer's written instructions, as shown on the drawings and as specified herein.

- B. Handling, storage, installation and energize of switchgears operations performed by the Manufacturer shall be carried out in accordance with latest edition of NEMA Publications PB 2.1.
- C. Freestanding switchgears shall be accurately aligned, leveled and bolted in place on full-length channels.
- D. Replace any panel pieces, doors or trims having dents, bends, warps or poor fit that may impede ready access, security or integrity.
- E. Check and tighten all bolts and connections with a torque wrench using manufacturer's recommended values.
- F. Complete all connections of the Switchgears to the transformer provided in Section 26 13 16.
- G. Include nameplates and warning signs as specified in Section 26 05 53.
- H. Provide permanent identification for each feeder and piece of equipment by means of plastic laminated nameplates. All nameplates shall conform to requirements of Section 26 05 53.
- I. Switchgears shall be anchored and braced to withstand seismic forces as calculated per Section 26 05 00.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Technician shall perform all quality control electrical testing, calibration and inspection required herein. Testing agencies objectives shall be to:
 - 1. Assure switchgear installation conforms to specified requirements and operates within specified tolerances.
 - 2. Field test mechanical operation and inspect to insure operation in accordance with manufacturer's recommendations and specifications.
 - 3. Perform insulation resistance test on each phase to ground and phase to phase. Record results for future reference.
 - 4. Perform low-frequency withstand tests according to ANSI/IEEE C37.20.3, paragraph 5.5.
 - 5. Perform contact resistance test across each switch blade; report any contact resistance in excess of 50 micro-ohms
 - 6. Prepare final test report including results, observations, failures, adjustments and remedies.
 - 7. Apply label on switchgear upon satisfactory completion of tests and results.
 - 8. Verify ratings and settings and make final adjustments.
- B. Field adjustments:
 - 1. The Manufacturer shall perform field adjustments of the protective devices as required to place the equipment in final operating condition.
- C. Owner Witnessed Testing: Allow a period of 2 hours per switchgear for the Owner's Representative to review and final check. This review shall be done when the switchgear is de-energized, therefore plan accordingly.
- D. Testing of overcurrent protective devices shall be done only after all devices are installed and system is energized.
- E. Prefunctional Testing

1. Provide testing agency with contract documents and manufacturer instructions for installation and testing.
 2. Visual and mechanical inspection:
 - a. Inspect for physical damage, defects alignment and fit.
 - b. Perform mechanical operational tests in accordance with manufacturer's instructions.
 - c. Compare nameplate information and connections to contract documents.
 - d. Check tightness of all control and power connections.
 - e. Check that all covers, barriers, and doors are secure.
 - f. Verify that relays and overcurrent protective devices meet specified requirements.
 3. Electrical Tests
 - a. Insulation Resistance: 1000 volt DC tests for one minute on all 600 volt and lower rated equipment, components, buses, feeder and branch circuits, and control circuits. Test phase-to-phase and phase-to-ground circuits showing less than 500 mega-ohms resistance to ground shall be repaired or replaced.
 - b. Circuit Continuity: All feeders shall be tested for continuity. All neutrals shall be tested for improper grounds.
 - c. Ground Resistance: Test resistance to ground of system and equipment ground connection.
 - d. Test overcurrent protection devices per applicable standards listed in paragraph 12.
- REFERENCES.

- F. In the event that the system fails to function properly during the testing, as a result of inadequate pretesting or preparation, the Manufacturer shall bear all costs incurred by the necessity for retesting including test equipment, transportation, subsistence and the Owner's Representative's hourly rate.
- G. Replace at no additional cost to the owner all devices that are found defective or do not operate within factory specified tolerances.
- H. Submit the testing agency's final report for review prior to project closeout and final acceptance by the owner. Test report shall indicate test dates, devices tested, results, observation, deficiencies and remedies. Test report shall be included in the operation and maintenance manuals.

3.6 CLEANING

- A. Prior to energizing of switchgears the Manufacturer shall thoroughly clean the interior of enclosure of all construction debris, scrap wire, etc. using manufacturer's recommended materials and methods.
- B. Touch-up paint any marks, blemishes, or other finish damage suffered during assembly.

END OF SECTION