

Section 16435 - SWITCHBOARDS**Introduction****Part 1 - General**

- Reference
 - The work under this section is subject to requirements of the Contract Documents including the General Conditions, Supplementary Conditions, and sections under Division 1 General Requirements.
- Description
 - Contractor shall furnish and install free-standing, dead-front type low-voltage distribution switchboards, utilizing group mounted circuit protective devices.
- Reference Standards
 - ANSI C37.13 – IEEE Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures
 - ANSI C37.17 – Trip Devices for AC and General Purpose DC Low-Voltage Power Circuit Breakers
 - NEMA PB2 – Dead Front Distribution Switchboards
 - NEMA KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
 - UL 489 – Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
 - UL-891 – Dead Front Switchboards
- Submittals
 - Shop Drawings
 - Submit shop drawings for equipment provided under this section
 - Shop drawings shall indicate:
 - Manufacture and model numbers of equipment and devices
 - General arrangement:
 - Plan view indicating overall dimensions, shipping splits and weights
 - Front elevation indicating location of devices and instruments
 - Section through switchgear showing space available for conduits
 - Seismic certification and equipment anchorage details
 - Electrical one-line drawings
 - Short circuit ratings of bus and interrupting rating of lowest rated device
 - Circuit schedules showing feeder circuit identification, device description, including trip unit or fuse clip rating
 - Schematic wiring diagram
 - Cable lug termination device
 - Time current characteristics curves
 - Main breakers
 - Feeder breakers
 - Ground fault relaying
 - Test data
 - Submit power distribution acceptance test reports to Engineer for review and acceptance, prior to energization of equipment.

- Instruction Manuals
 - In addition to Section 16000 – General Electrical Requirements, manual shall include the following:
 - Wiring diagrams for all systems.

Maintenance and Spare Parts

- Provide list of recommended spare parts
- Delivery, Storage, And Handling
 - Upon completion, assembly and testing by manufacturer of equipment specified, should it be found necessary for shipping and installation purposes to disassemble equipment, match-mark parts to facilitate erection in field.
 - Mark crates, boxes and cartons clearly to identify equipment. Show crate, box or carton identification number on shipping invoices.
 - Store switchboard units in clean, dry environment protected from elements. Maintain factory bracing, packaging and wrapping.
 - Handle units in accordance with manufacture's written handling instructions. Lift units only by manufacturers approved means.

Part 2 - Products

- Materials
 - Acceptable Manufactures: Cutler-Hammer, General Electric, Siemens
- Ratings
 - Assembly shall be rated to withstand fault current as shown on drawing
 - Nominal system voltage rating of switchboard shall be as shown on the drawings.
- Construction
 - Switchboard shall consist of vertical sections bolted together. Sides and rear shall be covered with removable bolt-on covers. Provide adequate ventilation within enclosure.
 - Switchboard sections shall be rear aligned. Protective devices shall be group mounted. Devices shall be front removable and load connections front accessible.
 - Assembly shall be provided with adequate lifting means.
 - Switchboard shall be suitable for use as service entrance equipment.
- Bus
 - General
 - Bus bars shall be silver-plated copper.
 - Main horizontal bus bars shall be mounted with all three phases arranged in same vertical plane.
 - Bus sizing shall be based on 65°C over 40°C ambient temperature outside the enclosure.
 - Provide a full capacity neutral bus.
 - Provide copper ground bus, sized per NEMA Standards, extending entire length of switchgear.
 - Bus Bar Connection
 - Bus bar connections shall be bolted.

- Bus joints shall be provided with conical spring-type washers.
- Clamp joints shall not be used.

- Wiring Terminations
 - Provide small wiring, necessary fuse blocks and terminal blocks within switchboard.
 - Control components mounted within assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.
 - Mechanical-type terminals shall be provided for all line and load terminations suitable for copper cable rated for 75°C.
 - Lugs shall be provided in incoming line section for connection of main grounding conductor.
 - Control wire shall be type SIS.
 - Control wire shall be bundled and secured with nylon ties.
 - Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device.
 - Current transformer secondary leads shall be connected to short-circuit terminal blocks.
 - Groups of control wires leaving the switchboard shall be provided with terminals blocks with suitable numbering strips. Provide wire markers at each end of control wiring.

- Protective Devices
 - Main Breaker
 - Main breaker shall be fixed insulated case circuit breaker, fully electronic, LSIG/LSI.
 - Breaker shall be listed for 100% continuous ampere rating.
 - Main breaker shall be provided with solid-state trip units.
 - Frame ampere ratings shall be as shown on drawings.
 - Main breakers shall be manually operated (MO).

 - Feeder Breakers
 - Feeder breakers shall be fully electronic molded case circuit breakers or Power Circuit Breakers, LSI. Thermal magnetic breakers are not acceptable.
 - Circuit breakers shall have minimum of symmetrical interrupting capacity as indicated on drawings.
 - Circuit breakers 200-ampere through 2500-ampere shall have microprocessor-based RMS sensing trip units.

 - Solid State Trip Units
 - Provide breakers, with solid-state microprocessor based trip units.
 - Unit shall consist of current sensors, solid-state trip device, flux transfer shunt trip and solid-state adjustable time/current curve shaping elements.
 - Solid state elements shall provide:
 - Long time current pickup settings and long time delay bands.
 - Short time current pickup settings and short time delay bands.
 - Instantaneous trip settings with switchable 12t ramp.
 - Ground fault pickup settings (where indicated on drawings).
 - Adjustments shall be made using non-removable, discrete steps.
 - Sealable transparent cover shall be provided over adjustments.
 - Ground Fault (where indicated on drawings):
 - Trip shall be provided as an integral part of breaker.
 - Pick-up shall be adjustable with maximum setting of 1200 amps.
 - Time delay shall be adjustable.

- Trip unit shall contain means to conduct circuit breaker tests.
- Breaker shall be equipped with externally accessible test points to be used for field testing.
- Customer Metering
 - Provide customer metering compartment with hinged door.
 - Current transformers for each meter. Current transformers shall be wired to shorting-type terminal blocks.
 - Potential transformers including primary and secondary fuses with disconnecting means.
 - Meter shall be microprocessor-based as manufactured by Veris.
 - The unit shall display the following:
 - Phase amperes (A, B, C).
 - Phase voltage (A-B, B-C, C-A, A-N, B-N, C-N).
- Enclosures
 - NEMA 1 with sprinkler shield, indoors.
 - NEMA 3R Gasketed Enclosure, indoors and outdoors
 - Finish
 - Exterior and interior of switchboard shall be ANSI-61 light gray. Indoors and sage green outdoors.
- Accessories
 - Lockout Devices:
 - Provide circuit breakers with integral, lockout/tagout devices.
 - Shunt trip devices:
 - Provide shunt trip bell alarms and auxiliary switches.
- Nameplates
 - Nameplates shall be secured to switchboard enclosure with screws.
 - Switchgear assembly:
 - Switchgear shall be provided with nameplate indicating manufacturer's name and drawing number.
 - In addition to name and drawing number, provided:
 - Voltage ratings (kV nominal; kV maximum design; kV BIL)
 - Main bus continuous rating (amperes)
 - Short-circuit ratings (amperes, rms symmetrical and Mva three-phase symmetrical)
 - Momentary and fault-closing ratings (amperes, rms asymmetrical)
 - Control components mounted within assembly shall be marked for identification corresponding to appropriate designation on manufacture's drawings.

Part 3 - Execution

- Inspection
 - Visually inspect equipment and components at time of delivery. Submit report to Owner/Engineer with list of items to be corrected.
- Factory Testing
- Standard Factory Tests Shall Be Performed On Equipment Provided Under This Section.

- Switchboard shall be completely assembled, wired, adjusted, and tested at factory.
- Manufacturer shall provide 3-certified copies of factory test reports.
- Installation
 - Contractors shall install equipment per manufacturer's instructions and contract drawings.
 - Assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to floor without use of floor sills provided floor is level to 1/8 inch per 3-foot distance in any direction. Necessary hardware to secure assembly in place shall be provided by Contractor.
 - Provide 4-inch high housekeeping pad for switchboards as indicated on drawings. Pad footprint shall be size to adequately support switchboard. Bolt switchboard securely to pad.
 - Protect equipment during installation to prevent twisting or deformation, exposure to damaging environments, and work of other trades. Maintain protection until completion of construction.
 - Prior to energization, factory representative shall visually inspect switchgear installation to insure that switches and motor operators are operable and bus connections are complete.
- Field Quality Control
 - Contractor shall perform field adjustments of protective devices as required to place equipment in final operating condition. Settings shall be in accordance with approved short-circuit study, protective device evaluation study and protective device coordination study.
 - Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with approved short circuit and protective device coordination study shall be carried out by Contractor at no additional cost to Owner.
 - Immediately prior to final inspection, thoroughly clean equipment. Refinish damaged enclosures to original quality.
- Acceptance Testing
 - Perform acceptance tests on switchboard in accordance with contract documents – Power Distribution Acceptance Tests. Adjust or replace equipment as needed to comply with manufacturer's specifications. Re-test device and submit new test reports.
 - Equipment shall have passed acceptance tests prior to energization.
 - Certified test report of standard production tests shall be available to Engineer upon request.
 - Switch operators shall be tested at least once after energization.
- Training
 - Contractor shall provide training session for up to [XXX] Owner's Representatives for one normal workday at a jobsite location determined by Owner.
 - Training session shall be conducted by Manufacturer's Qualified Representative. Training program shall consist of instruction on operation of assembly, circuit breakers, fused switches, and major components within assembly.

End of Appendix Section 16435