

SECTION 26 14 13 SWITCHBOARDS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. National Electrical Manufacturers Association (NEMA):
 - a. PB 2, Deadfront Distribution Switchboards.
 - b. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
2. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
3. UL:
 - a. 489, Standard for Safety for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.
 - b. 891, Standard for Safety for Switchboards.
 - c. 1561, Standard for Safety for Dry-Type General Purpose and Power Transformers.

1.02 SUBMITTALS

A. Action Submittals:

1. Descriptive product information.
2. Itemized Bill of Material.
3. Dimensional drawings.
4. Operational description.
5. Alternate Source-Transfer Controller.
6. One-line, three-line, and control schematic drawings.
7. Connection and interconnection Drawings.
8. Circuit Breakers: Copies of time-current characteristics.
9. Bus data.
10. Incoming line section equipment data.
11. Transformer section equipment data.
12. Conduit entrance locations.
13. Anchoring instructions and details.
14. Anchorage and bracing drawings and cut sheets, as required by Section 01 88 15, Anchorage and Bracing.

B. Informational Submittals:

1. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.
2. Manufacturer's installation instructions.

3. Factory Test Report.
4. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.
5. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 67 00, Product Requirements.

1.03 QUALITY ASSURANCE

A. Authority Having Jurisdiction (AHJ):

1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ to provide a basis for approval under NEC.
2. Materials and equipment manufactured within scope of standards published by UL shall conform to those standards and shall have an applied UL listing mark.

1.04 EXTRA MATERIALS

A. Furnish, tag, and box for shipment and storage the following spare parts:

1. Fuses: One complete set of spare fuses of each current rating, both power and control.
2. Lights: One complete set of spare indicating lights.
3. Paint: One pint, to match enclosure exterior finish in color and quality.

PART 2 PRODUCTS

2.01 SWITCHBOARDS

A. Physical Characteristics:

1. Lifting lugs on equipment and devices weighing over 100 pounds.
2. Stationary Structure: Sections bolted together to form one rigid assembly capable of being moved into position and bolted directly to floor without use of floor sills.
3. Enclosure:
 - a. Equipment Finish: Manufacturer's standard.
 - b. Indoor Enclosure:
 - 1) Rear, full-height, bolt-on panels for each enclosure section.
 - 2) Cable Termination Access: Padlock provision.
 - 3) Front Access Only:
 - a) Service line and load terminations, internal devices, device and bolted bus connections, and protective device removal, serviceable from front only.

- b) Sections aligned across back to permit placement flush against wall.
 - c) Working Space: As required by NFPA 70.
 - 4) Side and Top Covers: Removable, captive, screw-on plates with formed edges on each side.
 - 5) Front Cover: Hinged door with formed edges.
 - 4. Buswork:
 - a. Bus Arrangement: A-B-C, left-to-right, top-to-bottom, and front-to-rear, as viewed from front.
 - 5. Terminal Blocks:
 - a. Enclosed in steel wiring troughs.
 - b. Provide terminal blocks for:
 - 1) Conductors connecting to circuits external to switchboard.
 - 2) Internal circuits crossing shipping splits.
 - 3) Equipment parts requiring replacement and maintenance.
 - c. Spare Terminals: Not less than 20 percent.
 - d. Group terminal blocks for external circuit wiring leads.
 - e. Maintain 6-inch minimum space between columns of terminal blocks.
 - f. Identification: Permanent, for each terminal and columns of terminal blocks.
 - 6. Identification:
 - a. Nameplates:
 - 1) Master:
 - a) Deep-etched aluminum, with manufacturer's name and model number.
 - b) Riveted to main vertical section.
 - 2) Circuit Breaker Cubicle and Door-Mounted Device:
 - a) Engraved, acrylic.
 - b) Color: White with black.
 - c) Characters: Block-type, 1/4-inch high.
 - d) Size: As required for three lines, with 15 characters per each line.
 - e) Inscription: As shown on one-line diagram.
 - f) Blank plates for future spaces.
 - g) Attachment Screws: Self-tapping, stainless steel panhead.
 - b. Section Identification:
 - 1) Stamped metallic, riveted to each vertical section.
 - 2) Serial number, bus rating, and section reference number.
 - 3) Size: Manufacturer's standard.
 - c. Cubicle Labels:
 - 1) Nonmetallic, applied inside each cubicle compartment.
 - 2) Device serial number, rating, and description.
 - d. Metering Instruments: Meter type identified on meter face below pointer or dial.

- e. Control Switches: Deep etched, aluminum escutcheon plate.
- f. Relays and Devices:
 - 1) Stamped metallic, riveted to instrument case.
 - 2) Manufacturer's name, model number, relay type, and rating data.
- g. Switchboard Sign:
 - 1) On front of switchboard.
 - 2) Engraved, acrylic.
 - 3) Size: As required.
 - 4) Color: Red with white.
 - 5) Characters: Gothic-type, 1 inch high.
 - 6) Inscription: DANGER/HIGH VOLTAGE/KEEP OUT.
- h. Attachment: Four rivets each sign.

B. Functional Characteristics:

- 1. Equipment suitable for 480Y/277-volt, three-phase, four-wire, solidly-grounded electrical system having available short-circuit current at line terminals as shown on the Drawings.
- 2. Suitable for use as service entrance equipment where required by code or where indicated on the Drawings.
- 3. Switchboard and its major components to be manufactured and assembled by single manufacturer in order to achieve standardization for appearance, operation and maintenance, spare parts replacement, and manufacturer's services.
- 4. Stationary Structure:
 - a. Type: NEMA PB 2 construction, dead front, completely metal enclosed, self-supporting.
- 5. Enclosure:
 - a. Indoor Enclosure: NEMA 250, Type 1:
 - b. Outdoor Enclosure:
 - 1) NEMA 250, Aisleless Type 3R.
 - 2) Space Heaters: Thermostatically controlled, rated 1,000-watt at 240 volts, operated at 120 volts, in each switchboard vertical section.
 - 3) Adjustable thermostat for temperature range of 50 degrees F to 70 degrees F.
- 6. Buswork:
 - a. Main Bus: Phase insulated tin-plated copper throughout entire length of sufficient cross-section to limit temperature rise at rated current to 55 degrees C.
 - b. Ground Bus:
 - 1) Tin-plated copper.
 - 2) Rating: 500 amperes.

- 3) Bolted to each vertical section.
 - 4) Bus Connections and Joints: Bolted with Belleville washers.
 - 5) Extend each bus entire length of switchboard with provisions for extension to future units.
7. Control Wiring:
 - a. Control, Instrumentation, and Power/Current Circuits: NFPA 70, Type SIS, single-conductor, Class B, stranded copper, rated 600 volts.
 - b. Transducer Output/Analog Circuits: Shielded cable rated 600 volts, 90 degrees C minimum.
 - c. Conductor Lugs: Preinsulated, self-locking, spade-type, with reinforced sleeves.
 - d. Identification: Individually, with permanent wire markers at each end.
 - e. Enclose in top and vertical steel wiring troughs, and front-to-rear in nonmetallic wiring troughs.
 - f. Splices: Not permitted in switchboard wiring.
 8. Terminal Blocks:
 - a. Rated 600 volts, 30 amperes minimum, one-piece barrier type with strap screws.
 - b. Shorting type for current transformer leads.
 9. Power Meter: As specified in Section 26 09 13, Power Measurement and Control.
 10. Surge Protective Devices: As specified in Section 26 43 00, Surge Protective Devices.

C. Performance Characteristics:

1. Comply with NEMA PB 2 and UL 891.
2. General Requirements:
 - a. Operating Conditions:
 - 1) Elevation: 7,500 feet above sea level.
 - 2) Ambient Temperature:
 - a) Indoor Equipment:
 - (1) Minimum: 30 degrees F.
 - (2) Maximum: 104 degrees F.
 - b) Outdoor Equipment:
 - (1) Minimum: Minus 40 degrees F.
 - (2) Maximum: 104 degrees F.
 - 3) Equipment shall be fully rated without derating for the above operating conditions.

2.02 PROTECTIVE DEVICES AND TRIP UNITS

A. Physical Characteristics: None.

B. Functional Characteristics:

1. Insulated-Case Circuit Breakers:
 - a. Main and Generator, Protective Devices: Fixed, individually mounted, UL 489 listed for 100 percent of continuous ampere rating, suitable for use with 75 degrees C wire at full 75 degrees C ampacity when mounted in switchboard. Main devices that can be adjusted to 1200 amperes or higher shall be provided with an energy-reducing maintenance switch with local indicator. Provide stored energy operators to OPEN and CLOSE main and generator alternate source breakers for backup generator automatic operation.
 - b. Arrangement: Fully rated main and branch feeder as shown.
 - c. Frame Sizes: As shown with solid-state trip units.
 - d. Two-step, stored energy mechanism with maximum of five cycle closings.
 - e. Operation: Manual with multiple charge/close and antipump provisions.
 - f. Control Power Voltage: 120V ac.
2. Molded-Case Circuit Breakers:
 - a. Branch Feeder Protective Devices: Group mounted.
 - b. Arrangement: As shown.
 - c. Breakers 225-Ampere Frame and Above: Continuously adjustable magnetic pickups five to ten times trip rating.
 - d. Breakers 400-Ampere Frame and Above: Solid-state trip unit.
 - e. Interrupting Rating: 35,000 amperes rms symmetrical at rated voltage of 480V.
 - f. Mechanical interlock to prevent opening compartment door while breaker is in closed position.
3. Breaker Accessories:
 - a. For Indoor Switchboards: Breaker lifter, travel rail on top of switchboard.
 - b. For Outdoor Switchboards: Portable breaker lifter.
4. Solid State Trip Units:
 - a. Flux-shift trip and current sensors.
 - b. Protective Programmers:
 - 1) Self-powered, automatic rms sensing micro-electronic processor.
 - 2) No external relays or accessories.
 - 3) Printed circuit cards with gold-plated contacts.

- 4) Programmable Controls:
 - a) Fixed-point, with repetitive accuracy and precise unit settings.
 - b) Trip adjustments made by nonremovable, discrete step switching.
- 5) Field-Installable Rating Plugs:
 - a) Long-time pickup LED indicator and test receptacle.
 - b) Matching load and cable requirements.
 - c) Interlocked with tripping mechanism.
 - d) Breaker to remain trip-free with plug removed.
 - e) Keyed rating plugs to prevent incorrect application.
- 6) Long-time pickup light.
- 7) Selective Coordination Time/Current Curve Shaping Adjustable Functions:
 - a) Current setting.
 - b) Long-time pickup.
 - c) Long-time delay.
 - d) Short-time pickup feeders.
 - e) Short-time delay with I2T function, and IN-OUT switch.
 - f) Ground fault pickup.
 - g) Ground fault delay with I2T function.
- 8) Fault Trip Indicators: For overload and short-circuit plus ground fault trip.
- c. Rejection Pins: For each programmer frame size.

C. Performance Characteristics:

- 1. General Requirements:
 - a. Operating Conditions:
 - 1) Elevation: 7,500 feet above sea level.
 - 2) Ambient Temperature:
 - a) Indoor Equipment:
 - (1) Minimum: 30 degrees F.
 - (2) Maximum: 104 degrees F.
 - b) Outdoor Equipment:
 - (1) Minimum: Minus 40 degrees F.
 - (2) Maximum: 104 degrees F.
 - 3) Equipment shall be fully rated without derating for the above operating conditions.
- 2. Insulated-Case Circuit Breakers:
 - a. Interrupting Rating: 35,000 amperes rms symmetrical at rated voltage of 480V.
 - b. Two-step, stored energy mechanism with maximum of 5 cycle closings.

- c. Operation: Manual with multiple charge/close and antipump provisions.
 - d. Operational Sequence: CHARGE-CLOSE-RECHARGE-OPEN-CLOSE-OPEN.
- 3. Molded-Case Circuit Breakers:
 - a. Branch Feeder Protective Devices: Suitable for use with 75 degrees C wire at full 75 degrees C ampacity when mounted in switchboard.

2.03 ALTERNATE SOURCE-TRANSFER CONTROLLER

A. Refer to Section 26 36 23, Automatic Transfer Controller.

B. Operating Description:

- 1. Transfer on Loss and Return of Source Voltage:
 - a. The source-transfer control shall utilize the common-bus primary-selective system. The normal condition shall be with the utility source closed to energize the bus, and with the generator source open with its associated circuit available as a standby. The control shall monitor the conditions of both power sources and shall initiate automatic switching when the utility-source voltage has been lost (or reduced to a predetermined level) for a period of time sufficient to confirm that the loss is not transient. Automatic switching shall open the utility source main breaker and then close the generator breaker to restore power to the bus.
 - b. When normal utility voltage returns and is stable for a preset time, the control shall initiate retransfer to the utility source if in the automatic return mode, or await manual retransfer if in the hold return mode. In the hold return mode, if the generator fails and the utility source has been restored, the control shall initiate automatic retransfer to the preferred source.
 - c. In the automatic return mode, the control shall provide open transition (non-paralleling) on retransfer.

2.04 FACTORY TESTING

A. Performance tests in accordance with UL 891 and production tests in accordance with NEMA PB-2.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions and recommendations.
- B. Secure to mounting pads with anchor bolts of sufficient size and number adequate for specified seismic conditions.
- C. Install plumb and in longitudinal alignment with pad or wall.
- D. Coordinate terminal connections with installation of secondary feeders.

3.02 MANUFACTURER'S SERVICES

- A. Furnish manufacturer's representative in accordance with Section 01 79 00, Demonstration and Training, for the following services at Site, for minimum person-days listed below, travel time excluded:
 - 1. 1 person-day for installation assistance, final adjustment, and initial energization of equipment.
 - 2. 1 person-day for functional and performance testing.
- B. Furnish startup services and training of Contracting Officer's personnel at such times as requested by Contracting Officer.

END OF SECTION

