

SECTION 16400 – POWER DISTRIBUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes power distribution devices and associated auxiliary equipment rated 600 V and less for the following types:
 1. Lighting and appliance branch-circuit panelboards.
 2. Distribution panelboards.
 3. Overcurrent protective devices.
 4. Disconnect switches and enclosed circuit breakers.
 5. Fuses.

1.03 SUBMITTALS

- A. Submit product data for each type of panelboard, overcurrent protective device, disconnect switch, enclosed circuit breaker and fuse. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Submit shop drawings for each panelboard to include the following:
 1. Dimensioned plan, elevation and section views, and details. Show tabulations of installed devices, equipment features, and ratings.
 2. Enclosure types and details for types other than NEMA 250, Type 1.
 3. Bus configuration, current, and voltage ratings.
 4. Short-circuit current rating.
 5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- C. Include the following product data for each fuse type indicated:
 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.

1.04 QUALITY ASSURANCE

- A. Provide electrical devices and equipment specified in this section that are UL listed and labeled.
- B. Comply with NEMA PB-1.
- C. Comply with NEMA AB 1 and NEMA KS 1.
- D. Comply with NFPA 70.
- E. Comply with NEMA FU 1.

1.05 COORDINATION

- A. Coordinate layout and installation of all power distribution devices and components with other construction, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.
- B. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- C. Coordinate overcurrent protection ratings with HVAC and refrigeration equipment nameplate limitations for maximum overcurrent protection size.

PART 2 - PRODUCTS

2.01 PANELBOARDS AND OVERCURRENT DEVICES

- A. Manufacturers:
 - 1. Subject to compliance with requirements, provide products by one of the following:
 - a. Panelboards, overcurrent protective devices, controllers, contactors, and accessories:
 - (1) Square D Co.
 - (2) Cutler-Hammer
 - (3) General Electric
 - (4) Siemens
- B. Panelboard Fabrication and Features:
 - 1. Enclosures shall be surface mounted cabinets unless otherwise indicated on the drawings. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
 - a. Outdoor Locations: NEMA 250, Type 3R.
 - b. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 2. Enclosure fronts shall be secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Front doors shall be hinged.
 - 4. Finish shall be manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
 - 5. Directory card with transparent protective cover, mounted inside panelboard door.
 - 6. Bussing shall be hard-drawn copper, 98 percent conductivity.
 - 7. Main and neutral lugs shall be mechanical type suitable for use with conductor material.
 - 8. Equipment ground bus shall be adequate for feeder and branch-circuit equipment ground conductors, and shall be bonded to the enclosure.
 - 9. Panelboards used as main service entrances shall have a UL service entrance equipment label.
 - 10. Furnish mounting brackets, bus connections, and all necessary hardware and provisions required for installation of future devices in panelboard spaces.
- C. Short-Circuit Rating:
 - 1. Furnish a UL label indicating the short-circuit rating of the panelboard.
- D. Lighting and Appliance Branch-Circuit Panelboards:

1. Branch overcurrent protective devices shall be 1" wide bolt-on circuit breakers, replaceable without disturbing adjacent units.
 2. Doors shall be front mounted with concealed hinges; secured with flush latch with tumbler lock. All panelboards with doors shall be keyed alike.
- E. Distribution Panelboards:
1. Where indicated on the drawings, furnish doors that are front mounted, secured with vault-type latch with tumbler lock; keyed alike.
 2. Branch overcurrent protective devices shall be one of the following:
 - a. Circuit breakers with frame sizes 125 A and smaller shall be bolt-on type.
 - b. Circuit breakers with frame sizes larger than 125 A shall be bolt-on or UL approved clamp-on circuit breakers.
- F. Overcurrent Protective Devices:
1. Molded-Case Circuit Breaker shall meet NEMA AB 1, with interrupting capacity as indicated on the drawings.
 - a. Thermal-magnetic circuit breakers shall have an inverse time-current element for low-level overloads, and an instantaneous magnetic trip element for short circuits. Furnish circuit breakers with adjustable magnetic trip setting for frame sizes larger than 250 amperes.
 - b. Furnish circuit breakers larger than 800 ampere frame size with electronic trip units with RMS sensing, field-replaceable rating plug, and with the following field-adjustable settings:
 - (1) Instantaneous trip.
 - (2) Long- and short-time pickup levels.
 - (3) Long- and short-time time adjustments.
 - c. Furnish circuit breakers 1000 ampere frame size and larger with electronic trip units with RMS sensing, field-replaceable rating plug, and with the following field-adjustable settings:
 - (1) Instantaneous trip.
 - (2) Long- and short-time pickup levels.
 - (3) Long- and short-time time adjustments.
 - (4) Ground-fault pickup level, time delay, and I^2t response.
 - d. GFCI type circuit breakers used in single and two-pole configurations shall have 5-mA trip sensitivity.
 2. Molded-Case Circuit-Breaker Features and Accessories:
 - a. Lugs shall be the mechanical style, suitable for number, size, trip ratings, and material of conductors.
 - b. Furnish circuit breakers rated type SWD for switching lighting loads and type HACR for heating, air-conditioning, and refrigerating equipment.
 - c. Units with ground-fault protection shall have an integrally mounted relay and trip unit with push-to-test feature, and ground-fault indicator.
 - d. Units furnished with a shunt trip option shall be equipped with a 120-Vac trip coil energized from separate circuit unless otherwise indicated on the drawings.
 - e. Molded-case circuit breakers shall trip on undervoltage at voltages 75 percent of rated voltage or less, without intentional time delay.

2.02 DISCONNECT SWITCHES AND ENCLOSED CIRCUIT BREAKERS

- A. Manufacturers:
1. Subject to compliance with requirements, provide products by one of the following:
 - a. Disconnect Switches and Enclosed Circuit Breakers:
 - (1) Square D Co. Cutler-Hammer Products.
 - (2) Cutler-Hammer

- (3) General Electric
- (4) Siemens

- B. Disconnect Switches:
1. Enclosed, nonfusible disconnect switches shall be NEMA KS 1, type heavy duty, with lockable handle.
 2. Enclosed, fusible disconnect switches, 800 amperes and smaller shall be NEMA KS 1, type HD, with rejection clips to accommodate specified fuses only, lockable handle, and handle interlocked with cover latch.
- C. Overcurrent Protective Devices:
1. Molded-Case Circuit Breaker shall meet NEMA AB 1, with interrupting capacity as indicated on the drawings.
 - a. Thermal-magnetic circuit breakers shall have an inverse time-current element for low-level overloads, and an instantaneous magnetic trip element for short circuits. Furnish circuit breakers with adjustable magnetic trip setting for frame sizes larger than 250 amperes.
 - b. Furnish circuit breakers larger than 800 ampere frame size with electronic trip units with RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings:
 - (1) Instantaneous trip.
 - (2) Long- and short-time pickup levels.
 - (3) Long- and short-time time adjustments.
 - c. Furnish circuit breakers 1000 ampere frame size and larger with electronic trip units with RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings:
 - (1) Instantaneous trip.
 - (2) Long- and short-time pickup levels.
 - (3) Long- and short-time time adjustments.
 - (4) Ground-fault pickup level, time delay, and I^2t response.
 - d. GFCI type circuit breakers shall be furnished in single and two-pole configurations with 5-mA trip sensitivity.
 2. Molded-Case Circuit-Breaker Features and Accessories:
 - a. Lugs shall be the mechanical style, suitable for number, size, trip ratings, and material of conductors.
 - b. Furnish circuit breakers rated type SWD for switching lighting loads and type HACR for heating, air-conditioning, and refrigerating equipment.
 - c. Units with ground-fault protection shall have an integrally mounted relay and trip unit with push-to-test feature, and ground-fault indicator.
 - d. Units furnished with a shunt trip option shall be equipped with a 120-Vac trip coil energized from separate circuit unless otherwise indicated on the drawings.
 - e. Molded-case circuit breakers shall trip on undervoltage at voltages 75 percent of rated voltage or less, without intentional time delay.
- D. Enclosures:
1. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
 - a. Outdoor Locations: NEMA 250, Type 3R.
 - b. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
- E. Factory Finishes:
1. Finish shall be manufacturer's standard gray paint applied to factory-assembled enclosures before shipping.

PART 3 - EXECUTION

3.01 PANELBOARDS

- A. Panelboard Installation:
 - 1. Install panelboards and accessories according to NEMA PB 1.1.
 - 2. Mounting heights of panelboards shall be 74 inches (1880 mm) above finished floor to the top of the trim, unless otherwise indicated.
 - 3. Install panelboards plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
 - 4. Type panelboard directory cards to indicate installed circuit loads.
 - 5. Install factory furnished filler plates in all unused panelboard spaces.
 - 6. Stub four 1-inch empty conduits from each flush-mounted panelboard into accessible space above the ceiling or space designated to be ceiling space in the future, for future circuiting.
- B. Panelboard Identification:
 - 1. Label each panelboard with a laminated-plastic nameplate.
- C. Panelboard Connections:
 - 1. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
 - 2. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- D. Panelboard Field Quality Control:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit. Test continuity of each circuit.
- E. Panelboard Adjusting:
 - 1. Set field-adjustable circuit-breaker trip ranges in accordance with settings recommended in factory furnished short-circuit and coordination study specific in Section 16010 "STARTUP SERVICES AND TRAINING".
- F. Panelboard Cleaning:
 - 1. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

3.02 DISCONNECT SWITCHES AND ENCLOSED CIRCUIT BREAKERS

- A. Examination:
 - 1. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
 - a. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Identification:
 - 1. Identify field-installed conductors, interconnecting wiring, and components.
 - 2. Furnish and install engraved laminated plastic nameplates for all electrical enclosures.
- C. Connections:

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- D. Field Quality Control:
1. Test each disconnect switch and enclosed circuit breaker for proper operation.
- E. Adjusting:
1. Set field-adjustable circuit-breaker trip ranges.
- F. Cleaning:
1. On completion of installation, inspect and clean interior and exterior of all electrical enclosures. Repair any damaged surfaces to match original finish.

END OF SECTION 16400