

SECTION 16450

PANELBOARDS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Section includes requirements for panelboards providing fault interrupting capability and overcurrent protective devices.

1.02 REFERENCE STANDARDS

- A. California Code of Regulations (CCR):
 - 1. Title 24, Part 3, California Electrical Code
- B. National Electrical Manufacturers Association (NEMA):
 - 1. NEMA AB1 Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures
 - 2. NEMA AB-4 Guidelines for Inspection and Preventative Maintenance Of Molded Circuit Breakers Used in Commercial and Industrial Applications
 - 3. NEMA PB1.1 General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less
 - 4. NEMA PB1 Panelboards
 - 5. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)
- C. International Electrical Testing Association (NETA):
 - 1. NETA ATS Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
- D. National Fire Protection Association (NFPA):
 - 1. NFPA 70 National Electrical Code (NEC)
- E. Underwriters Laboratories Inc. (UL):
 - 1. UL 50 Enclosures for Electrical Equipment, Non-Environmental Considerations
 - 2. UL 67 Panelboards
 - 3. UL486A-486B Wire Connectors

- 4. UL 489 Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
- 5. UL 943 Ground-Fault Circuit-Interrupters

1.03 SUBMITTALS

- A. Refer to Section 16000, Basic Electrical Requirements, for additional submittals and submittal requirements.
- B. Product Data: Submit for each type of panelboard, overcurrent protective device, transient voltage surge suppressor (TVSS) device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- C. Shop Drawings: Submit for each panelboard and related equipment.
 - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of panelboards and overcurrent protective devices.
 - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- D. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified under Quality Assurance herein.
- E. Test Procedure for Overcurrent Protective Devices: Test procedures shall comply with NEMA AB-4 guidelines.
- F. Field Test Reports: Submit written test reports and include the following:
 - 1. Test procedures used
 - 2. Test results that comply with requirements
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements
- G. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

- H. Maintenance Data: Submit operations and maintenance manuals for panelboards and components as specified in Section 01730, Operations and Maintenance Manuals.
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.04 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.05 MAINTENANCE MATERIALS

- A. Keys: Furnish six spare keys of each type of panelboard cabinet lock.
- B. Accessory Set: Furnish tools and miscellaneous items required for test, inspection, maintenance, and operation.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Panelboards shall comply with UL 67 requirements. Include the following panelboards:
 - 1. Lighting and appliance branch-circuit panelboards
 - 2. Distribution panelboards

2.02 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed.
- B. Panelboards, Overcurrent Protective Devices, and Accessories:
 - 1. Eaton Corp.; Cutler-Hammer Products
 - 2. General Electric Co.; Electrical Distribution & Control Division
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D Company
 - 5. Or Engineer approved equal

2.03 FABRICATION AND FEATURES

- A. Enclosures: Surface-mounted cabinets. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
- B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
- C. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- D. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- E. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.
- F. Bus: Hard-drawn copper, 98 percent conductivity.
- G. Main and Neutral Lugs: Mechanical type suitable for use with conductor material.
- H. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- I. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- J. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- K. Skirt for Surface-Mounted Panelboards: Same gauge and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.

2.04 PANELBOARD SHORT-CIRCUIT RATING

- A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.05 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- B. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.06 DISTRIBUTION PANELBOARDS

- A. Doors: Front mounted, except omit in fused-switch panelboards; secured with vault-type latch with tumbler lock; keyed alike.
- B. Main Overcurrent Protective Devices: Circuit breaker.
- C. Branch overcurrent protective devices shall be one of the following:

1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

2.07 OVERCURRENT PROTECTIVE DEVICES

- A. General: Devices shall be the latest approved design as manufactured by a nationally recognized manufacturer and in conformity with applicable standards and listings of nationally recognized testing laboratories. Devices shall comply with UL requirements 489, 50, 67 and 943.
 1. Overcurrent protective devices shall be molded-case circuit breakers as specified herein.
- B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- C. Breakers shall be bolt-on type suitable for individual as well as panelboard mounting. Breakers shall be bolt-on type, no "plug-on" type panelboard breakers allowed.
- D. Breakers shall meet current National Electrical Manufacturers Association (NEMA) and Underwriters Laboratories (UL) specifications as applicable to frame size, standard rating, and interrupting capability.
- E. Breakers shall be one, two, or three pole as scheduled, and shall be of the quick-make, quick-break thermal magnetic type. They shall be trip free to prevent closing when a fault exists. The handle positions shall clearly indicate "ON", "OFF", and "TRIPPED" positions. Two pole breakers shall be physically the same size as two single-pole breakers, thereby permitting any combination of one, two, or three pole breakers.
- F. Operating handle shall open and close all poles simultaneously on a multi-pole breaker.
- G. Provide Class A (5ma sensitivity) breakers where GFI Type breakers are required.
- H. Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.
- I. Lugs: Mechanical style, suitable for number, size, trip ratings, and material of conductors.
- J. Size overcurrent protective devices as shown on the panel schedule in the Contract Documents or as required by the load being served. Provide separate neutral conductors for circuits protected by GFI breakers.

2.08 FEATURES

- A. Fungus Proofing: Permanent fungicidal treatment for panelboard interior, including overcurrent protective devices and other components.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements for seismic zone 4 location.
- C. Mounting Heights: Top of trim 74 inches above finished floor, unless otherwise indicated.
- D. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Circuit Directory: Refer to Section 16000, Basic Electrical Requirements. Create a directory to indicate installed circuit loads after balancing panelboard loads.
- F. Install filler plates in unused spaces.
- G. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

3.02 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 16000, Basic Electrical Requirements.

3.03 CONNECTIONS

- A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
- B. 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.

3.04 FIELD QUALITY CONTROL

- A. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

- B. Balancing Loads: When all loads are connected, measure load balancing and make circuit changes as follows:
 - 1. Measure as directed during period of normal system loading.
 - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.
 - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
 - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
- C. Infrared Scanning: When all loads are connected, perform an infrared scan of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.
 - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
 - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 3. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.06 CLEANING

- A. 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.

END OF SECTION