

SECTION 16160CP - PANELBOARDS

PART 1 - GENERAL

- 1.1. This section includes design and performance requirements for the following:
 - A. Service-entrance panelboards
 - B. Power distribution panelboards
 - C. Lighting and appliance panelboards
 - D. Multi-section panelboards.
- 1.2. References:
 - 1.2.1. National Fire Protection Association (NFPA)
 - A. National Electrical Code (NEC) Article 384 – Switchboards and Panelboards
 - 1.2.2. National Electrical Manufacturer’s Association (NEMA):
 - A. NEMA AB 3 - Molded Case Circuit Breakers and Their Application.
 - B. NEMA PB-1 – Panelboards
 - C. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
 - D. NEMA 110 – Enclosures
 - 1.2.3. National Electrical Contractor’s Association (NECA):
 - A. NECA 407 – Recommended Practice for Installing and Maintaining Panelboards
 - 1.2.4. Underwriters Laboratories (UL):
 - A. UL 50 – Enclosures for Electrical Equipment
 - B. UL 67 – Panelboards
 - C. UL 489 – Molded Case Circuit Breakers and Circuit Breaker Enclosures
- 1.3. Quality Assurance:
 - 1.3.1. Panelboards and overcurrent protective devices shall comply with applicable requirements of NEMA, NEC and UL standards for the intended application.
 - 1.3.2. Panelboards shall bear the Underwriters' Laboratories (UL) Label.
 - 1.3.3. Panelboard installation shall comply with NECA Standard of Installation, NEC

requirements and as specified herein.

1.4. Submittals:

1.4.1. Product Data: Submit product literature detailing electrical ratings, dimensions, materials of construction, mounting and installation details, applicable wiring diagrams, enclosure type, nameplate information and accessories.

1.4.2. Installation and Handling Instructions: Submit application conditions and limitations of use stipulated by product testing agency. Submit instructions for storage, handling, protection, examination preparation, installation and startup of product.

1.5. Compatibility:

1.5.1. All panelboards and associated overcurrent protective devices shall be the product of the same manufacturer. Where switchboards and switchgear are also provided under this project, panelboards shall be of the same manufacturer.

PART 2 - PRODUCTS

2.1. Panelboards – General:

2.1.1 Provide panelboards, enclosures and accessory components of the sizes, types and ratings required, which comply with the manufacturer's standard materials, design and construction in accordance with published product information. Equip with types and quantities of overcurrent protective devices and accessories as required for a complete installation.

2.1.2 Comply with UL, NEC, and established industry standards for the applications indicated.

2.1.3 Panelboards shall be designed so that switching and protective devices may be added or replaced without disturbing adjacent units or main bus connectors, and shall be so designed that circuits may be changed without drilling, machining or tapping the bus.

2.1.4 Panelboards shall be of the dead-front safety-type, with bolt-on type, molded case thermal-magnetic circuit breakers, of the type, quantity and ratings as required.

2.1.5 Panelboards scheduled to have main circuit breakers shall be configured with vertically mounted main breakers, unless otherwise required.

2.1.6 Panelboards scheduled for use as Service Entrance equipment shall be UL-labeled for this duty.

2.1.7 Load center-type Panelboards: Load center-type Panelboards are not acceptable except for residential or apartment use. Load centers shall generally comply with the requirements for circuit breaker type Panelboards, except that plug-in type breakers are acceptable, and panel door latches are acceptable in lieu of lockable doors. Circuit breakers shall be of the full-size type: half-size or twin circuit breakers are not acceptable. Where required, load centers shall be rated for service entrance use.

2.2 Bussing:

2.2.1 Panel board main bussing shall be bare or tin-plated copper. Bussing shall be full rated throughout the height of the panel.

2.2.2 Neutral bussing shall be full rated, and electrically isolated from the cabinet. Neutrals shall be 200% rated for all K-rated panel applications.

2.2.3 Panelboards shall be provided with a copper ground bus equal to a minimum of 1/2 the capacity of the phase bus. Ground bus shall be electrically bonded to the cabinet. Where isolated ground bus is required, provide an additional, full-rated ground bus in the panel, electrically isolated from both the neutral and panel ground bus.

2.2.4 Panel board lugs shall be designed to accept copper or aluminum wire.

2.3 Branch Circuit Over-Current Protective Devices:

2.3.1 Circuit breaker Panelboards shall have automatic short circuit and over-current protective devices having an "on", "off", and tripped position of the operating handle. Multi-pole breakers shall common trip and be so designed that an overload on one pole automatically causes all poles to open. Circuit breakers shall be of the quick-make and quick-break type, and shall have inverse time trips. Tandem mounted breakers are not acceptable.

2.3.2 All circuit breakers shall be clearly and visibly marked on the handles for their ampere trip rating. Panel and breaker designs where the panel trim must be removed to determine trip rating are not acceptable.

2.3.3 Circuit breakers in frame sizes larger than 100A shall be manually operated with a mechanism for adjusting instantaneous and overload trip settings.

2.3.4 Panelboards designated for use as lighting panelboards with circuit breakers as the source of switch control shall have branch circuit breakers U.L. listed as type SWD for lighting circuits.

2.3.5 All circuit breakers shall have 75 degree C rated terminals, suitable for copper or

aluminum wire.

- 2.3.6 Provide circuit breakers with switched neutral, ground-fault trip, arc-fault trip or shunt trip capacity where required.
- 2.3.7 Provide circuit breakers with handle locking devices to prevent manual breaker operation where required.
- 2.3.8 Where new circuit breakers are to be installed within existing panelboards, they shall be listed for use with the existing panelboard type, and of sufficient short circuit rating for the application.

2.4 Interrupting Capacity:

- 2.4.1 Panel board bussing, main and branch circuit breakers shall be rated for the minimum fault current level available on the system. Where fault current information is not readily available, the following ratings shall apply:
 - 120-208/240 VAC panels rated 225 amps and less shall be rated for 10,000 AIC minimum.
 - 120-208/240 VAC panels rated over 225 amps shall be rated for 22,000 AIC minimum.
 - 277/480 VAC panels rated 225 amps and less shall be rated for 14,000 AIC minimum.
 - 277/480 VAC panels rated over 225 amps shall be rated for 25,000 AIC minimum.
- 2.4.2 Panelboards shall be fully rated, versus series rated, unless specifically directed otherwise.

2.5 Cabinets and Trim:

- 2.5.1 Cabinets shall comply with NEMA PB1, without knockouts. Cabinets shall be of code gauge, galvanized sheet steel and equipment, with gutters of ample size for the risers and outgoing circuits. Provide panels with auxiliary gutters where panels are of the feed-through type. Cabinets and trim shall be thoroughly cleaned and trim shall be finished per the manufacturer's standard unless otherwise directed.
- 2.5.2 Cabinets shall be rated NEMA type-1 for dry interior areas, and type-4x for wet and exterior areas, unless otherwise directed.
- 2.5.3 Provide panelboards with a hinged door, combination spring lock and catch, directory frame and two (2) keys. Panels over 48 inches high shall be provided with 3-point type latches or multiple latches. All panel locks shall be keyed alike and a neatly typed directory identifying each circuit shall be provided in the frame.

- 2.5.4 Trim clamps, locks and hinges shall be of the concealed type.
 - 2.5.5 Panelboards shall be suitable for flush or surface mounting, as required for the application.
 - 2.5.6 Panelboards shall be furnished with lockable or screw-type, hinged, door-in door type cabinet trims.
- 2.6 Separately Enclosed Molded Case Circuit Breakers:
- 2.6.1 Where separately enclosed molded case circuit breakers are required, provide circuit breakers in accordance with the requirements noted for panelboards.
 - 2.6.2 Enclosed circuit breakers scheduled for use as Service Entrance equipment shall be UL-labeled for this duty.
 - 2.6.3 Enclosed circuit breaker cabinets shall be rated NEMA type-1 for dry interior areas, and type-4x for wet and exterior areas, unless otherwise directed.

PART 3 - EXECUTION

3.1 Installation – General:

- 3.1.1 Installation of panelboards shall be in accordance with Article 384 of the NEC, the manufacturer's instructions and applicable NECA installation requirements.
- 3.1.2 Minimum working clearances around panelboards shall be in accordance with Article 110 of the NEC.
- 3.1.3 Panelboards shall be installed plumb and the top of the enclosure shall not exceed six feet above finished floor. For panelboards that exceed six feet overall, install such that the bottom of the enclosure is no more than six inches above finished floor and the centerline of the top-most device handle does not exceed six foot six inches above finished floor.
- 3.1.4 For panelboards located in areas accessible to the Public, paint the exposed panelboard surfaces to match the adjacent wall surfaces after the panelboard installation is completed.
- 3.1.5 Where new panelboard interiors are installed within existing panel backboxes, the existing backboxes shall be thoroughly cleaned of rust and scale. The interiors shall then be painted with a white, rust-inhibiting paint before the new interior is installed. New exterior panel trims, doors and locks shall then be provided for these panels. Provide new, typewritten panelboard circuit directories for all panelboard replacements to clearly identify the loads served.

- 3.1.6 Where new circuit breakers are installed or added to existing panelboards, update the existing circuit directory with a new typewritten label(s) to clearly identify the load(s) served.

3.2 Installation – Detailed:

- 3.2.1 Anchor panel board back boxes to walls and structural surfaces, ensuring that they are permanently and mechanically secure.
- 3.2.2 All terminations shall be properly and accurately torqued per manufacturer's specifications using the appropriate torque screw driver or torque wrench.
- 3.2.3 Circuits sharing a common neutral shall not be connected to the same phase bus.
- 3.2.4 Calibrate adjustable-trip circuit breakers per Engineer's instructions.
- 3.2.5 All unused spaces shall have filler plates installed.
- 3.2.6 Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.
- 3.2.7 Each panel board shall have a neatly-typed circuit directory installed, clearly identifying the loads served by each branch circuit breaker.
- 3.2.8 Provide and install a plastic engraved nameplate for each panelboard detailing the following: Panel designation; Panel operating voltage; Source and circuit number of Panelboard supply (for disconnection and isolation).
- 3.2.9 Visual and Mechanical Inspection: Inspect completed panelboards for physical damage, proper alignment, anchorage and grounding. Recheck proper installation and tightness of connections.
- 3.2.10 All Panelboards shall be left clean, with all debris removed from gutters and enclosures.
- 3.2.11 All scratches and digs shall be repainted to match the finish paint color.

END OF SECTION