

## SECTION 26 24 16

### PANELBOARDS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

###### A. Section Includes:

1. Power panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Disconnecting and overcurrent protective devices.

##### 1.2 DEFINITIONS

- A. GFEP: Ground-fault equipment protection.
- B. MCCB: Molded-case circuit breaker.
- C. VPR: Voltage protection rating.

##### 1.3 ACTION SUBMITTALS

###### A. Product Data:

1. Power panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Disconnecting and overcurrent protective devices.
4. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
5. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

###### B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Include evidence of listing, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for series rating of installed devices.

7. Include evidence of listing, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for SPD as installed in panelboard.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include wiring diagrams for power, signal, and control wiring.
10. Key interlock scheme drawing and sequence of operations.
11. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include Internet link for electronic access to downloadable PDF of coordination curves.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Warranty documentation.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation in accordance with NEMA PB 1.

#### 1.6 WARRANTY

- A. Special Installer Extended Warranty: Installer warrants that fabricated and installed panelboards perform in accordance with specified requirements and agrees to repair or replace components or products that fail to perform as specified within extended-warranty period.
  1. Extended-Warranty Period: 5 years from date of Substantial Completion; full coverage for labor, materials, and equipment.

### PART 2 - PRODUCTS

#### 2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

- A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- B. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing agency recognized by authorities having jurisdiction, and marked for intended location and application.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.

- E. Enclosures: Surface-mounted, dead-front cabinets.
1. Rated for environmental conditions at installed location.
    - a. Indoor Dry and Clean Locations: UL 50E, Type 1 .
    - b. Outdoor Locations: UL 50E, Type 3R .
    - c. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: UL 50E, .
  2. Height: 7 ft maximum.
  3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims must cover live parts and may have no exposed hardware.
  4. Finishes:
    - a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - b. Back Boxes: Galvanized steel .
- F. Incoming Mains:
1. Location: Top .
  2. Main Breaker: Main lug interiors up to 400 A must be field convertible to main breaker.
- G. Phase, Neutral, and Ground Buses:
1. Material: Hard-drawn copper, 98 percent conductivity.
    - a. Plating must run entire length of bus.
    - b. Bus must be fully rated for entire length.
  2. Interiors must be factory assembled into unit. Replacing switching and protective devices may not disturb adjacent units or require removing main bus connectors.
  3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
  4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure.
  5. Do not mount neutral bus in gutter.
  6. .
- H. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
  2. Terminations must allow use of 75 deg C rated conductors without derating.
  3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
  4. Main and Neutral Lugs: Compression Mechanical type, with lug on neutral bar for each pole in panelboard.
  5. Ground Lugs and Bus-Configured Terminators: Compression Mechanical type, with lug on bar for each pole in panelboard.
  6. Feed-Through Lugs: type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
  7. Subfeed (Double) Lugs: type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
  8. .

- I. Quality-Control Label: Panelboards or load centers must be labeled, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers must have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- J. Future Devices: Panelboards or load centers must have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
  - 1. Percentage of Future Space Capacity: 20 percent.
- K. Panelboard Short-Circuit Current Rating:
  - 1. Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for 100 percent interrupting capacity.
    - a. Panelboards and overcurrent protective devices rated 240 V or less must have short-circuit ratings as shown on Drawings, but not less than 10 000 A(rms) symmetrical.
    - b. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V must have short-circuit ratings as shown on Drawings, but not less than 14 000 A(rms) symmetrical.
- L. Surge Suppression: Factory installed as integral part of indicated panelboards, complying with UL 1449 SPD Type 1 .

## 2.2 POWER PANELBOARDS

- A. Listing Criteria: NEMA PB 1, distribution type.
- B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
  - 1. For doors more than 36 inch high, provide two latches, keyed alike.
- C. Mains: Circuit breaker .
- D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers .
- E. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
  - 1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.

## 2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Listing Criteria: NEMA PB 1, lighting and appliance branch-circuit type.

- B. Mains: Circuit breaker .
- C. Branch Overcurrent Protective Devices: Plug-in Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Contactors in Main Bus: NEMA ICS 2, Class A, electrically mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
  - 1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
  - 2. External Control-Power Source: 120 V branch circuit 24 V control circuit .
- E. Doors: Door-in-door construction with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

## 2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers:
    - a. Inverse time-current element for low-level overloads.
    - b. Instantaneous magnetic trip element for short circuits.
    - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  - 3. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6 mA trip).
  - 4. MCCB Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Breaker handle indicates tripped status.
    - c. UL listed for reverse connection without restrictive line or load ratings.
    - d. Lugs: style, suitable for number, size, trip ratings, and conductor materials.
    - e. Ground-Fault Protection: relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards in accordance with NECA 407 NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's published instructions.
- B. Reference Standards:
  - 1. Panelboards: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NEMA PB 1.1.
  - 2. Consult Architect for resolution of conflicting requirements.
- C. Special Techniques:
  - 1. Equipment Mounting:
    - a. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.
  - 2. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
  - 3. Mount top of trim 7.5 ft above finished floor unless otherwise indicated.
  - 4. Mount panelboard cabinet plumb and rigid without distortion of box.
  - 5. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
  - 6. Install overcurrent protective devices and controllers not already factory installed.
    - a. Set field-adjustable, circuit-breaker trip ranges.
    - b. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver in accordance with manufacturer's published instructions.
  - 7. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
  - 8. Install filler plates in unused spaces.
  - 9. Stub four 1 inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in future. Stub four 1 inch empty conduits into raised floor space or below slab not on grade.
- D. Interfaces with Other Work:
  - 1. 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, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems."
- B. Panelboard Nameplates: Label each panelboard with nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- C. Device Nameplates: Label each branch circuit device in power panelboards with nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- D. Install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems" identifying source of remote circuit.
- E. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles must be located on interior of panelboard door.
- F. Breaker Labels: Faceplate must list current rating, UL and IEC certification standards, and AIC rating.
- G. Circuit Directory:
  - 1. Provide directory card inside panelboard door, mounted in transparent card holder .
    - a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits.
  - 2. Provide computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
    - a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits.
  - 3. Create directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

### 3.4 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as indicated.
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.
  - 1. Measure loads during period of normal facility operations.
  - 2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.

3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
4. Tolerance: Maximum difference between phase loads, within panelboard, may not exceed 20 percent.

### 3.5 PROTECTION

- A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature in accordance with manufacturer's published instructions.

END OF SECTION 26 24 16