

**SECTION 26 24 16**  
**PANELBOARDS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies the furnishing, installation and connection of panelboards.

**1.2 RELATED WORK**

- A. Section 09 91 00, PAINTING: Identification and painting of panelboards.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one Section of Division 26.
- C. Section 26 05 71, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY:  
Requirements for the over current protective devices to be installed to ensure proper equipment and personnel protection.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits and outlet boxes.
- E. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- F. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:  
Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

**1.3 SUBMITTALS**

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
  - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
  - 2. Include electrical ratings, dimensions, mounting details, materials, wiring diagrams accessories and weights of equipment. Complete nameplate data including manufacturer's name and catalog number.
- C. Certification: Two weeks prior to final inspection, submit four copies of the following to the Resident Engineer:
  - 1. Certification that the material is in accordance with the drawings and specifications has been properly installed, and that the loads are balanced.

#### 1.4 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

A. National Electrical Manufacturers Association (NEMA):

PB-1-2006.....Panelboards

AB-1-2002.....Molded Case Circuit Breakers, Molded Case  
Switches and Circuit Breaker Enclosures

B. National Fire Protection Association (NFPA):

70-2005 .....National Electrical Code (NEC)

70E-2004.....Standard for Electrical Life Safety in the  
Workplace

C. Underwriters Laboratories, Inc. (UL):

50-2003.....Enclosures for Electrical Equipment

67-2003.....Panel boards

489-2006.....Molded Case Circuit Breakers and Circuit  
Breaker Enclosures

#### PART 2 - PRODUCTS

##### 2.1 PANELBOARDS

A. Panelboards shall be in accordance with UL, NEMA, NEC, and as shown on the drawings.

B. Panelboards shall be standard manufactured products. All components of the panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards to be of the same manufacturer.

C. All panelboards shall be hinged "door in door" type with:

1. Interior hinged door with hand operated latch or latches as required to provide access to circuit breaker operating handles only, not to energized ports.

2. Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips or other fasteners requiring a tool for entry.

3. Push inner and outer doors shall open left to right.

D. All panelboards shall be completely factory assembled with molded case circuit breakers. Include one-piece removable, inner dead front cover independent of the panelboard cover.

- E. Panelboards shall have main breaker or main lugs, bus size, voltage, phase, and flush or surface mounting as scheduled on the drawings.
- F. Panelboards shall conform to NEMA PB-1, NEMA AB-1 and UL 67 and have the following features:
1. Nonreduced size copper or aluminum bus bars, complete with current ratings as shown on the panel schedules connection straps bolted together and rigidly supported on molded insulators.
  2. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type. Single-phase, three-wire panelboard busing shall be such that when any two adjacent single-pole breakers are connected to opposite phases, two-pole breakers can be installed in any location. Three-phase, four-wire busing shall be such that when any three adjacent single-pole breakers are individually connected to each of the three different phases, two-or three-pole breakers can be installed at any location. Current-carrying parts of the bus assembly shall be plated. Mains ratings shall be as shown.
  3. Mechanical lugs furnished with panelboards shall be cast, stamped or machined metal alloys of sizes suitable for the conductors indicated to be connected thereto.
  4. Neutral bus shall be 100% rated, mounted on insulated supports.
  5. Grounding bus bar equipped with screws or lugs for the connection of grounding wires.
  6. Buses braced for the available short circuit current, but not less than 22,000 amperes symmetrical for 120/208 volt and 120/240 volt panelboards, and 14,000 amperes symmetrical for 277/480-volt panelboards.
  7. Branch circuit panels shall have buses fabricated for bolt-on type circuit breakers.
  8. Protective devices shall be designed so that they can be easily replaced.
  9. Where designated on panel schedule "spaces" or "provisions", include all necessary bussing, device support and connections. Provide blank cover for each space.
  10. In multi section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side of main lugs only, or through-feed lugs for main breaker type panels, and with cable connections to the second

section. Panelboard sections with tapped bus or crossover bus are not acceptable.

11. Series rated panelboards are not permitted.
12. All lighting and appliance panelboards, whether single or multi-section, rated 400A or less, shall be equipped with spare subfeed lugs so that the panelboard may readily have an additional section added.

G. Manufacturer: Subject to compliance with requirements, provide products manufactured by Schneider Electric (Square D) or an approved equal.

## **2.2 CABINETS AND TRIMS**

A. Cabinets:

1. Provide galvanized steel cabinets to house panelboards. Cabinets for outdoor panels shall be factory primed and suitably treated with a corrosion-resisting paint finish meeting UL 50 and UL 67.
2. Cabinet enclosure shall not have ventilating openings.
3. Cabinets for panelboards may be of one-piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.

## **2.3 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS**

A. Breakers shall be UL 489 listed and labeled, in accordance with the NEC, as shown on the drawings, and as specified.

B. Circuit breakers in panelboards shall be bolt on type on phase bus bar or branch circuit bar.

1. Molded case circuit breakers for lighting and appliance branch circuit panelboards shall have minimum interrupting rating as indicated but not less than:
  - a. 120/208 Volt Panelboard: 10,000 amperes symmetrical.
  - b. 277/480 Volt Panelboard: 25,000 amperes symmetrical.
2. Molded case circuit breakers shall have automatic, trip free, inverse time, and instantaneous magnetic trips for 100-ampere frames or less. Instantaneous trip shall be adjustable on all breakers main frames 600A and higher and on smaller breakers where necessary for coordination. Breaker trip setting shall be set in the field based on the approved protective device study as specified in Section 26 05 71, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY. Circuit breakers shall be provided to coordinate with upstream devices as follows:

- a. Provide devices that achieve the maximum selectivity possible using molded case circuit breakers from the manufacturer's standard catalog of devices. Provide feeder breakers with electronic trip units to increase selectivity with downstream devices. Non-electronic devices will be permitted for feeder breakers only where they are able to fully achieve the requirements listed in (b) and (c) below.
  - b. Provide devices that achieve full selectivity for all values of fault current for the short time and long time portions of the trip curve.
  - c. Provide devices that give full selectivity for all values of fault current for all time greater than 0.1s.
  - d. Devices with a larger frame or sensor than the value indicated on the drawings, with the long time trip appropriately set to the value indicated on the drawings by a rating plug or adjustment, shall be provided at no additional cost to the Government if necessary to comply with these requirements.
3. Adjustable Trip Molded Case Circuit Breakers:
- a. For power distribution panels, provide molded case, solid state adjustable trip type circuit breakers for all feeder breakers (breakers serving a panelboard, MCC, or other piece of equipment with multiple branch circuit or feeder overcurrent devices, and the transformers feeding them).
  - b. Trip units shall have field adjustable tripping characteristics as follows:
    - i. Ampere setting (continuous).
    - ii. Long time band.
    - iii. Long time delay.
    - iv. Short time trip point.
    - v. Short time delay.
    - vi. Instantaneous trip point where the highest setting shall be a minimum 10x the long time band highest setting.
    - vii. Ground fault trip point.
    - viii. Ground fault trip delay.
  - c. Trip settings shall be as indicated on the drawings. Final settings shall be shown on the electrical system protective device study.

d. Breakers, which have same rating, shall be interchangeable with each other.

C. Breaker features shall be as follows:

1. A rugged, integral housing of molded insulating material.
2. Silver alloy contacts.
3. Arc quenchers and phase barriers for each pole.
4. Quick-make, quick-break, operating mechanisms.
5. A trip element for each pole, thermal magnetic or electronic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
6. Electrically and mechanically trip free.
7. An operating handle which indicates ON, TRIPPED, and OFF positions.
  - a. Line connections shall be bolted.
  - b. Interrupting rating shall not be less than the maximum short circuit current available at the line terminals as indicated on the drawings, and as shown on the electrical system protective device study as required in Section 26 05 71, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY
8. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.
9. Shunt trips shall be provided where indicated
10. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory. All modified directories shall be typed. Handwritten modifications will be rejected.

#### **2.4 SEPARATELY ENCLOSED MOLDED CASE CIRCUIT BREAKERS**

- A. Where separately enclosed molded case circuit breakers are shown on the drawings, provide circuit breakers in accordance with the applicable requirements of those specified for panelboards.
- B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the breakers are being installed.

#### **2.5 INTERNALLY INTEGRATED SURGE PROTECTIVE DEVICES:**

- A. Provide surge suppressor on panelboards indicated on the drawings, on all service entrance panelboards and all panelboards fed directly from an automatic transfer switch.
- B. Integral Surge Suppressor:

1. SPD (Surge Protective Devices) shall be Component Recognized and listed in accordance with UL 1449 Second Edition to include Section 37.3 highest fault category testing on devices intended for service entrance use. SPD shall also be UL 1283 listed.
2. SPD shall be UL 67 listed, installed by and shipped from the electrical distribution equipment manufacturer's factory.
3. SPD shall provide surge current diversion paths for all modes of protection; L-N, L-G, N-G, in WYE systems, and L-L, L-G in DELTA systems.
4. SPD shall be modular in design. Each mode shall be fused with a 200kAIC UL recognized surge rated fuse and incorporate a thermal cutout device.
5. SPD shall be integrally mounted to the bus bars of the panelboard.
6. Audible diagnostic monitoring shall be by way of audible alarm. This alarm shall activate upon a fault condition. An alarm on/off switch shall be provided to silence the alarm. An alarm push to test switch shall be provided as well.
7. SPD shall meet or exceed the following criteria:
  - a. Maximum surge current capability (single pulse rated) per phase shall be:
    - 1) Service Entrance Switchboard 250 kA.
    - 2) Distribution Panelboards 160 kA
    - 3) Branch Panelboards 160 kA
  - b. UL 1449 Second Edition Listed and Recognized Component Suppression Voltage Ratings (SVR's) for Service Entrance and Distribution Location equipment shall not exceed the following:
  - c. Voltage Let-Thru Values for Solidly Grounded Systems:

VOLTAGE	L-N	L-G	N-G
208Y/120	400V	400V	400V
480Y/277	800V	800V	800V

8. SPD shall have a minimum EMI/RFI filtering of -50Db at 100 kHz with an insertion ration of 50:1 using MIL-STD-220A methodology.
9. SPD shall have the following diagnostic features: transient counter, status lights on each phase, and one set of 1 NO and 1 NC auxiliary dry contacts for alarming.

10. SPD shall have a warranty for a period of five years, incorporating unlimited replacements of suppressor parts if transients destroy them during the warranty period. Warranty shall be the responsibility of the electrical distribution equipment manufacturer and shall be supported by their respective field service division.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Installation shall be in accordance with the Manufacturer's instructions, the NEC, as shown on the drawings, and as specified.
- B. Locate panelboards so that the present and future conduits can be conveniently connected. Coordinate the sizes of cabinets with designated closet space.
- C. In accordance with Section 09 91 00, PAINTING, paint the panelboard system voltage, and feeder sizes as shown on the riser diagram in 1 inch block lettering on the inside cover of the cabinet door. Paint the words "LIFE SAFETY BRANCH", "CRITICAL BRANCH", or "EQUIPMENT SYSTEM" as applicable and the panel designation in one inch block letters on the outside of the cabinet doors.
- D. Install a typewritten schedule of circuits in each panelboard after being submitted to and approved by the Resident Engineer. Schedules, after approval, shall be typed on the panel directory cards and installed in the appropriate panelboards, incorporating all applicable contract changes pertaining to that schedule. Include the room numbers and items served on the cards.
- E. Mount the panelboard fully aligned and such that the maximum height of the top circuit breaker above finished floor shall not exceed 1980 mm (78 inches). For panelboards that are too high, mount panelboard so that the bottom of the cabinets will not be less than 150 mm (6 inches) above the finished floor.
- F. Panelboards shall not be installed in areas accessible to the public.
- G. Directory-card information shall be typewritten to indicate outlets, lights, devices, and equipment controlled and final room numbers served by each circuit and shall be mounted in holders behind protective covering.
- H. Where new panels are to be installed in existing backboxes, backboxes shall have rust and scale removed from inside. Paint inside of



backboxes with rust preventive paint before the new panel interior is installed. Provide new trim and doors for these panels. Covers shall fit tight to the box with no gaps between the cover and the box.

I. Provide ARC flash identification per NFPA 70E.

- - - E N D - - -