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 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.

D. 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.

E. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits and outlet boxes.

F. Section 26 09 23, LIGHTING CONTROLS: Lighting controls integral to panelboards.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. In addition to the requirements of Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

1. Shop Drawings:
   a. Sufficient information, shall be clearly presented to determine compliance with drawings and specifications.
   b. Include electrical ratings, dimensions, mounting details, materials, wiring diagrams, accessories, and weights of equipment. Complete nameplate data, including manufacturer’s name and catalog number.
2. Manuals:
   a. When submitting the shop drawings, submit companion copies of complete maintenance and operating manuals, including technical data sheets and wiring diagrams.

b. If changes have been made to the maintenance and operating manuals that were originally submitted, then submit four copies of updated maintenance and operating manuals to the COR two weeks prior to final inspection.

3. Certification: Two weeks prior to final inspection, submit four copies of the following to the COR:
   a. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
   b. Certification by the contractor that the materials have been properly installed, connected, and tested.

1.5 APPLICABLE PUBLICATIONS

A. 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 designation only.

B. National Electrical Manufacturers Association (NEMA):
PB-1-06.....Panelboards
250-08.....Enclosures for Electrical Equipment (1000V Maximum)

C. National Fire Protection Association (NFPA):
70-2005 .....National Electrical Code (NEC)
70E-2004.....Standard for Electrical Life Safety in the Workplace

D. Underwriters Laboratories, Inc. (UL):
50-95.....Enclosures for Electrical Equipment
67-09.....Panelboards
489-09.....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.

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 only to circuit breaker operating handles, not to energized parts.

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. Hand-operated latches are not acceptable.
3. Push inner and outer doors shall open left to right.

D. Unless noted otherwise, all new panelboards shall be completely factory-assembled with molded case circuit breakers and integral accessories, such as metering devices per Section 25 10 10, ADVANCED UTILITY METERING and as scheduled on the drawings or specified herein. 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, top or bottom feed, 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. Non-reduced size copper bus bars with current ratings as shown on the panel schedules, rigidly supported on molded insulators.
2. Bus bar connections to the branch circuit breakers shall be the “distributed phase” or “phase sequence” type.
3. Mechanical lugs furnished with panelboards shall be cast, stamped, or machined metal alloys of sizes suitable for the conductors to which they will be connected.
4. Neutral bus shall be 100% rated, mounted on insulated supports.
5. Grounding bus bar shall be equipped with screws or lugs for the connection of grounding wires.
6. Buses shall be braced for the available short-circuit current. Bracing shall be as noted on schedules and not be less than 10,000 A symmetrical for 120/208 V panelboards, and 14,000 A symmetrical for 277/480 V panelboards.
7. Branch circuit panelboards shall have buses fabricated for bolt-on type circuit breakers.
8. Protective devices shall be designed so that they can easily be replaced.
9. Where designated on panel schedule "spaces," include all necessary bussing, device support, and connections. Provide blank cover for each space.
10. In two 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 panelboards, and have cable connections to the second section. Panelboard sections with tapped bus or crossover bus are not acceptable.

11. Series-rated panelboards are not permitted.

2.2 CABINETS AND TRIMS

A. Cabinets:

1. Provide galvanized steel cabinets to house panelboards. Cabinets for outdoor panelboards 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. Circuit breakers shall be per UL 489, in accordance with the NEC, as shown on the drawings, and as specified.

B. Circuit breakers in panelboards shall be bolt-on type.

C. Molded case circuit breakers shall have interrupting rating equal to the panelboard rating in which the breaker is being installed in, but not less than:

1. 120/208 V Panelboard: 22,000 A symmetrical.
3. 277/480 V Panelboard: 14,000 A symmetrical.

D. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100 A frame or lower. Magnetic trip shall be adjustable from 3x to 10x for breakers with 600 A frames and higher. Factory setting shall be HI, unless otherwise noted.

E. 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 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.

8. An overload on one pole of a multipole breaker shall automatically cause all the poles of the breaker to open.
9. Ground fault current interrupting breakers, shunt trip breakers, lighting control breakers (including accessories to switch line currents), or other accessory devices or functions 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 accordingly.

2.4 METERING

A. Where indicated on the drawings, provide a digital line Meter Monitor device having the features and functions specified below. In addition, the device shall meet the accuracy portion of ANSI C12.16 Class 10 for revenue metering. The device shall consist of a single microprocessor-based unit capable of monitoring and displaying the functions listed below with the accuracy indicated. The device shall have the capability to communicate data via twisted pair network, more specifically MODBUS protocol. The device shall be UL listed, CSA and CE certified and also meet ANSI standard C37.90.1 for surge withstand.

B. New panels provided under this project shall be supplied with a meter that is installed in the panelboard cabinet. For existing panels, meter shall mount in a separate enclosure next to feeders into the top or bottom of panel.

C. The device display shall mount in a standard DIN 96 mm x 96 mm square cutout or a standard ANSI round 100 mm cutout and shall offer a display via a standard Category 5 cable. The meter base shall be capable of being remote panel or DIN-rail mountable or mounting directly to the display. The membrane faceplate shall be designed and tested to allow mounting in NEMA 1 enclosures. The device display shall be a 4 x 20 character LED backlit LCD display to allow simultaneous viewing of multiple parameters.

D. All monitored parameters shall be viewable at the display or via network communications. The meter shall be completely programmable using the display keypad or via network communications. All set points and recorded minimum and maximums shall be stored in non-volatile memory.

E. Metered Values shall be as follows with accuracy in percent of full scale as indicated:

1. AC Phase Voltage and Amperes +/- 0.5%
2. Watts, VA, Vars +/- 1.0%
3. Power Factor +/- 2.0%
4. Frequency +/- 0.1 Hz
5. Watthours, VA, Varhours +/- 1.0%
6. Watt Demand with 10-, 15-, 20-, 25-, 30-, 45-, 60-minute interval
7. Minimum/Maximum Voltage, Current, Power, Power Factor, Frequency
8. Peak Demand

F. Input ranges of the device shall accommodate external current transformers with ranges from 5/5 through 8000/5 amperes. Provide current transformers with rating to match panelboard as indicated on the drawings. Fused potential transformers shall be internal for voltages up to 600 volts.

G. For new panel meter applications, control power shall be capable of being supplied from the monitored incoming ac line without the need for a separate ac supply control circuit. New metering on existing panels shall receive control power via 20A/1P circuit breaker located in panel meter is associated with.

H. A solid-state relay KYZ pulse output shall be provided for use with a watthour pulse recorder or totalizer.

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.

C. Install a printed schedule of circuits in each panelboard after approval by the COR. Schedules shall be printed on the panelboard directory cards, installed in the appropriate panelboards, and incorporate all applicable contract changes. Information shall indicate outlets, lights, devices, or other equipment controlled by each circuit, and the final room numbers served by each circuit.

D. Mount the fully-aligned panelboard such that the maximum height of the top circuit breaker above the finished floor shall not exceed 78 in. Mount panelboards that are too high such that the bottom of the cabinets will not be less than 6 in above the finished floor.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. Include the following visual and mechanical inspections and electrical tests:

1. Visual and Mechanical Inspection
   a. Compare equipment nameplate data with specifications and approved shop drawings.
   b. Inspect physical, electrical, and mechanical condition.
   c. Verify appropriate anchorage and required area clearances.
   d. Verify that circuit breaker sizes and types correspond to approved shop drawings.
   e. To verify tightness of accessible bolted electrical connections, use the calibrated torque-wrench method or perform thermographic survey after energization.
   f. Clean panelboard.

3.3 FOLLOW-UP VERIFICATION

Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the panelboards are in good operating condition and properly performing the intended function.

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