SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General Requirements for Panelboards
2. Distribution Panelboards
3. Lighting and Appliance Branch-Circuit Panelboards
4. Disconnecting and Overcurrent Protective Devices
5. Accessory Components and Features

B. Meet the following performance requirements:

1. Seismic Performance: In accordance with Section 26 00 10.
2. Environmental Limitations:
   a. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
   b. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
      1) Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).
      2) Altitude: Not exceeding 6600 feet (2000 m).
3. Service Conditions: NEMA PB 1, usual service conditions, as follows:
   a. Ambient temperatures within limits specified.
   b. Altitude not exceeding 6600 feet (2000 m).

1.2 RELATED WORK

A. Section 26 00 10 – Basic Electrical Requirements, is an integral part of this Section. Requirements and work indicated in 260010 are not repeated in this Section.

B. Section 26 08 00 – Electrical General Commissioning Requirements. Provide Installer's and Manufacturer's support as required to coordinate with the Commissioning Agent and support all commissioning efforts and paperwork, Acceptance and Integrated Systems Testing.

1.3 COORDINATION

A. Coordinate work under provisions indicated in Section 26 00 10:

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Construction Manager, Contractor, and Owner no fewer than seven (7) days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Construction Manager's, Contractor's, and Owner's written permission.
3. Comply with NFPA 70E.

C. Coordinate housekeeping pad dimensions, required openings, etc. using manufacturer's shop drawings.

D. Coordinate recessed panelboards dimensions and surface mounted panelboard support requirements and locations.

1.4 QUALIFICATIONS / QUALITY ASSURANCE

A. Conform to requirements indicated in Section 26 00 10.

B. Field verify measurements.

1.5 REGULATORY REQUIREMENTS AND STANDARDS

A. Conform to requirements indicated in Section 26 00 10.

B. Codes and Standards in addition to Section 26 00 10 requirements:

1. NEMA AB 1 - Molded Case Circuit Breakers.
2. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
3. NEMA KS 1 - Enclosed Switches.
4. NEMA PB 1 - Panelboards.
5. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
6. NEMA PB 1.2 - Application Guide for Ground-fault Protective Devices for Equipment.
7. UL 489 - Protective Device Series Rating.
8. FS W-C3750a - Circuit Breakers, Molded Case, Branch Circuit and Service.
9. FS W-P-115 - Power Distribution Panel.

C. Coordinate housekeeping pad dimensions, required openings, etc. using manufacturer's shop drawings.

D. Coordinate recessed panelboards dimensions and surface mounted panelboard support requirements and locations.

1.6 SUBMITTALS

A. Submit as required here in and under Section 26 00 10.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

1.7 EXTRA MATERIALS

A. Furnish under provisions indicated in Section 26 00 10.

B. Provide the following additional materials:

1. Six of each panelboard key.
2. Two spare circuit breaker lock-on devices for each panelboard.
3. Three spare circuit breakers for each size and type in addition to units indicated on the Drawings where space is available in the panelboards.

1.8 PROJECT RECORD DOCUMENTS

A. Submit under provisions indicated in Section 26 00 10.

B. Record actual locations of Products; indicate actual branch circuit arrangement.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit under provisions indicated in Section 26 00 10.

B. Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.10 WARRANTY

A. Provide under provisions indicated in Section 26 00 10.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 26 00 10 and Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush- and surface - mounted cabinets as indicated on drawings.

1. Rated for environmental conditions at installed location.
   a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
   b. Outdoor Locations: NEMA 250, Type 3R.
   c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
   d. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250 Type 12.
2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
3. Finishes:
   a. Panels and Trim: 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.
4. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Incoming Mains Location: As indicated on drawings.

D. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box where indicated on drawings.
4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads where indicated on drawings.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus-Configured Terminators: Compression type.
4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device where indicated on drawings.
5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device where indicated on drawings.
6. Gutter-Tap Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device where indicated on drawings.
7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus where indicated on drawings.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices. Provide for all spaces not scheduled for devices to completely fill panelboard.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

H. Minimum integrated short circuit rating: 10,000 amperes RMS symmetrical for 240 volt rated panelboards; 65,000 amperes RMS symmetrical for 480 volt panelboards, provide higher where indicated on the Drawings or the Overcurrent Protective Device Coordination study.

2.2 DISTRIBUTION PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements provide the product indicated on the Drawings or the first listed manufacturer or product below. Subject to compliance with requirements a comparable product by one of the others listed may be acceptable:

1. Panelboards for PBB (House) Electrical rooms shall match existing manufacturer within the building.
2. Panelboards for Suite shall match manufacturer of switchboard and existing suites within the building.
3. Substitutions: Under provisions of Section 26 00 10.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

D. Mains: As indicated on Drawings.

E. Branch Overcurrent Protective Devices for Circuit-Breakers: Bolt-on circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements provide the product indicated on the Drawings or the first listed manufacturer or product below. Subject to compliance with requirements a comparable product by one of the others listed may be acceptable:

1. Panelboards for PBB (House) Electrical rooms shall match existing manufacturer within the building.
2. Panelboards for Suite shall match manufacturer of switchboard and existing suites within the building.
3. Substitutions: Under provisions of Section 26 00 10.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only as indicated on drawings or required by code.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 LOAD CENTERS (NOT USED)

2.5 ELECTRONIC-GRADE PANELBOARDS (NOT USED)

2.6 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Basis-of-Design Product: Subject to compliance with requirements provide the product indicated on the Drawings or the first listed manufacturer or product below. Subject to compliance with requirements a comparable product by one of the others listed may be acceptable:

1. PBB (House) - shall match existing manufacturer within the building.
2. Suite - shall match manufacturer of switchboard and existing suites within the buildingSubstitutions: Under provisions of Section 26 00 10.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, 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.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with RMS sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and I^2t response.
4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits; type HACR for HVAC loads.
   d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   e. Shunt Trip: 120 V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
   f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
   g. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 26 Section "Fuses."
2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.

2.7 PANELBOARD SUPPRESSORS

A. Provide at dedicated panels for the primary and secondary POP rooms. Refer to Section 26 43 13 Surge Protective Devices (SPD) for low voltage electrical power circuits.

2.8 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

1. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
2. Provide permanent lockout capability per OSHA requirements on overcurrent devices.
3. Provide lock-on devices on the circuits serving the following systems.
   a. Fire Alarm System
   b. Security System
   c. ATC, BMS, BAS Control Panel
   d. Emergency Lighting
   e. EPO Systems

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NECA 407, NEMA PB 1.1 and NFPA 70B.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NECA 407 and NEMA PB 1.1.

B. Floor Mounted Equipment Mounting: Install panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete and Miscellaneous Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to panelboards.
5. Securely attach panelboard to the vertical finished or structural surface behind the panelboard. Attach to solid surface, blocking or unistrut spanning multiple studs.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

E. Mount top of trim 7'-6" or 90 inches (2286 mm) maximum above finished floor unless otherwise indicated. Verify the operating handle of top-most switch or circuit breaker, in on position, is not higher than 79 inches (2000 mm) above finished floor or grade.

F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box. Provide supports.

G. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges as indicated on drawings or according to the coordination settings reports.

H. Install filler plates in unused spaces.

I. Stub four 1-inch (27-GRC) empty conduits from recessed panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade. Label each as spare.

J. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

K. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section 26 05 53 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section 26 05 53 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

E. Tests and Inspections:

1. In accordance with Division 26 Section 26 08 13 – Testing of Electrical Systems, perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. 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.

F. Panelboards will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated and as specified in the Overcurrent Protective Device Coordination Study.

C. Load Balancing: After Substantial Completion, but not more than 30 days after Final Acceptance, measure load balancing and make circuit changes.

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.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

B. Verify all locks on devices are installed.

3.7 SEALING

A. In computer rooms, environmental chambers, pressure controlled rooms, etc. provide seals for all conduits that leave the room. Seal conduits with pliable non-hardening material such as duc seal or an environmental seal fittings Refer to Section 26 00 05 – Provide Seal at Conduit Entry to Panelboard.

3.8 INTEGRATED SYSTEMS TESTING

A. Provide field technicians to support Integrated Systems Testing (commissioning Level 5) in addition to and after successful completion of acceptance testing (Level 4).

END OF SECTION