**SECTION 26 24 16**

**PANELBOARDS**

**BASED ON DFD MASTER ELECTRICAL SPEC DATED 09/03/24**

This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.

**PART 1 - GENERAL**

**SCOPE**

The work under this section includes main, distribution and branch circuit panelboards. Included are the following topics:

PART 1 - GENERAL

 Scope

 Related Work

 References

 Submittals

 Operation and Maintenance Data

 Spare Parts

PART 2 - PRODUCTS

 Power Distribution Panelboards

 Branch Circuit Panelboards

 Coordination Branch Panelboards

 Retrofit Panelboards

 Coordination of Overcurrent Protective Devices

PART 3 - EXECUTION

 Installation

 Field Quality Control

 Construction Verification Items

 Agency Training

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

Section 26 05 73 - Short Circuit/Coordination Study and Arc Flash Risk Assessment

Section 26 27 13 – Electricity Metering

Section 26 43 13 - Surge Protective Devices for Low Voltage Electrical Power Circuits

Section 26 08 00 - Commissioning of Electrical

Section 01 91 01 or 01 91 02 – Commissioning Process

**REFERENCES**

ANSI C57.13 – Instrument Transformers

NEMA AB 1 ‑ Molded Case Circuit Breakers

NEMA KS 1 ‑ Enclosed Switches

UL-891 ‑ Dead Front Switchboards

**SUBMITTALS**

Include outline and support point dimensions, voltage, main bus ampacity, circuit breaker arrangement and sizes, and interrupting ratings confirming a fully-rated system for all equipment and components.

Submit required short circuit coordination study per specification section 26 05 73 to the consulting engineer for review and approval. Submittal shall be on or before date of panelboard equipment submittal.

# OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

**SPARE PARTS**

Keys: Furnish 2 keys for each panelboard to Owner.

Handle lock-off: Furnish (2) 20/1P circuit breaker handle lock-off devices for each panelboard to Owner.

One set of three spare fuses of each size and type utilized.

**PART 2 - PRODUCTS**

***The consultant shall determine the panelboard features and devices needed for the application and delete the requirements for devices not used on the project.***

Power Distribution Panelboards shall be limited to 800A or less. Requirements for equipment larger shall utilize switchboards. Consult with DFD electrical staff for exceptions in specialty areas and remodeling/ retrofit projects.

**POWER DISTRIBUTION PANELBOARDS**

Panelboards: Circuit breaker or fusible switch type.

The panelboard and overcurrent devices contained within shall be **fully-rated.**

Enclosure: NEMA [Type 1.] [Type 3R.] [\_\_\_.] Minimum cabinet size: 6.5 inches (165 mm) deep; 26 inches (660 mm) wide. Constructed of galvanized code gauge steel.

Cabinet front cover and cabinet shall be Type 4X, 304 stainless steel in wet and damp locations including kitchen, foodservice and therapeutic/pool applications.

Power distribution panelboards installed in electrical rooms and mechanical rooms shall utilize a standard dead front cover. In all other areas provide cabinet front with hinged door, flush lock and hinged trim (door-in-door) to allow access to wiring gutters without removal of panel front. Hinged trim shall be held in place with screw fasteners. Finish in manufacturer's standard gray enamel.

Provide metal directory holders with clear plastic covers. Holder to be factory mounted.

Provide panelboards with copper bus (phase buses, bus fingers, etc.), ratings as scheduled on Drawings. Provide ground bars in all panelboards. Neutral and ground bars can be dual rated ALCU9. All spaces shall have bus fully extended and drilled for the future installation of breakers.

Minimum System (i.e. individual component) Short Circuit Rating: As shown on the Drawings and as required by short circuit/coordination study.

Main breakers shall be individually mounted. Back feed mains shall NOT be utilized.

The circuit breakers are to be totally front accessible and mounted in the panelboard to permit installation, maintenance and testing without reaching over line side bussing. The circuit breakers are to be removable by the disconnection of only the load side terminations and line and load side connections are to be individual to each circuit breaker. Common mounting brackets or electrical bus connectors are not acceptable.

Circuit breakers shall be provided with provisions for mounting handle padlock attachments.

Breaker feeder lugs shall be dual rated for use with either aluminum or copper conductors.

Each circuit breaker is to be furnished with an externally operable mechanical means to trip the circuit breaker, enabling maintenance personnel to verify the ability of the circuit breaker trip mechanism to operate, as well as exercise the circuit breaker operating mechanisms.

A minimum of 25% future circuit breaker spaces shall be included. Spaces for future circuit breakers shall be “prepared” spaces. These spaces shall be provided with the necessary mounting hardware and bus extensions so that when future breakers are added, only the breaker itself needs to be purchased by the installer.

Circuit breakers serving single motor loads shall be magnetic only, instantaneous trip. Overload protection shall be part of the motor combination controller.

Circuit breakers in 480V power distribution panelboards shall be fully adjustable LSI circuit breakers with electronic trip for frame sizes greater than 400A.

Circuit Breakers:

Electronic Trip Circuit Breakers: As scheduled on the drawings, electronic circuit breakers shall , at a minimum, adjustments for long time, short time and instantaneous trip. Provide integral ground fault sensing with adjustable ground fault trip as indicated on the drawings.

Molded Case Circuit Breakers: As scheduled on the drawings, integral thermal and instantaneous magnetic trip elements in each pole.

Fusible Distribution Switches:

Fusible switches shall be quick make, quick break and shall be group mounted in panel type construction. Switches of 30 amperes to 200 amperes shall have plug‑on line side connections. Each switch is to be contained in a separate steel enclosure. The enclosure shall employ a hinged cover for access to the fuses which shall be interlocked with the operating handle to prevent opening the cover when the switch is in the "ON" position.

This interlock shall be constructed so that it can be released with a standard electrician's tool for testing fuses without interrupting service. Units shall have padlocking provisions in "OFF" position and operating handle position shall give positive switch position indication, i.e. red for "ON" and black for "OFF". Switches shall pass industry standard I2t with-stand tests and fuse tests.

A minimum of 25% future fusible switch spaces shall be included. Spaces for future fusible switches shall be “prepared” spaces. These spaces shall be provided with the necessary mounting hardware and bus extensions so that when future fusible switches are added, only the fusible switch itself needs to be purchased by the installer.

The consultant shall review the Power Distribution Panelboard requirements when utilized for building service entrance equipment. Include requirements for external mounted meter (for owners use) and external mounted surge protection. Delete the accessories below if not needed.

Meter: Provide an electronic meter (with meter test switch and instrument transformers) for Owner’s use in the distribution panelboard. Meter and related equipment shall meet the requirements of specification section 26 27 13.

Surge Protective Device: Provide a surge protective device meeting the requirements of specification section 26 43 13. Surge protective devices shall be served from an overcurrent protective device within the power distribution panelboard. Surge protective device shall be installed external to the distribution panelboard.

**BRANCH CIRCUIT PANELBOARDS**

Lighting and Appliance Branch Circuit Panelboards: Circuit breaker type.

The panelboard and overcurrent devices contained within shall be **fully-rated.**

Enclosure: [Type 1.] [Type 3R.] [\_\_\_\_.] Minimum cabinet size: 5-3/4 inches (144 mm) deep; 20 inches (508 mm) wide with 5" minimum gutter space top and bottom. Constructed of galvanized code gauge steel. Panel enclosure (back box) shall be of non-stamped type (without KO's) to avoid concentric break out problem.

Cabinet front cover and cabinet shall be Type 4X, 304 stainless steel in wet and damp locations including kitchen, food service and therapeutic/pool applications.

Provide [flush] [surface] cabinet front with concealed trim clamps, concealed hinge and flush cylinder lock all keyed alike. Front cover shall be hinged to allow access to wiring gutters without removal of panel trim. Hinged trim shall be held in place with screw fasteners. Finish in manufacturer's standard gray enamel.

Provide metal directory holders with clear plastic covers. Holder to be factory mounted.

Provide panelboards with copper bus (phase buses, bus fingers, etc.), ratings as scheduled on Drawings.

Provide ground bars in all panelboards. Phase, neutral and ground bar terminations can be dual rated ALCU9. All spaces shall have bus fully extended and drilled for the future installation of breakers.

Incoming conductors shall terminate at lug landing pads rated for the panelboard.

Provide compression type lugs to accommodate the conductor shown on drawings.

Minimum System (i.e. individual component) Short Circuit Rating: As shown on the Drawings and as required by short circuit/ coordination study.

Molded Case Circuit Breakers: Bolt‑on type thermal magnetic trip circuit breakers. Provide UL Class A ground fault interrupter circuit breakers as shown on Drawings. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

Do not use tandem circuit breakers.

Circuit breakers shall be bolt-on type with common trip handle for all poles. No handle ties of any sort will be approved.

Provide a minimum of 10% spare circuit breakers in branch panelboards.

All of the panelboards provided under this section shall be by the same manufacturer.

The consultant shall review panelboard sizes and use of traditional single and double tub installations. Use of a single panelboard with greater than 42 circuits shall be discussed with DFD staff.

All panelboards installed side by side (double tub) shall utilize same enclosure height.

Double tub panelboard installations shall identify type of feed to adjacent panelboard- sub-feed or feed-thru. Identification shall be integral with panel label.

The consultant shall review the application and included branch panelboard metering and/or surge protection only if appropriate. Delete the accessories below if not needed.

[Meter: Provide an electronic meter (with meter test switch and instrument transformers) for Owner’s use in the Branch Circuit Panelboard. Meter and related equipment shall meet the requirements of specification section 26 27 13.]

[Surge Protective Device: Provide a surge protective device meeting the requirements of specification section 26 43 13.]

The consultant shall utilize coordination branch panelboards for NEC Article 517, 700 and 701 coordination requirements.

**COORDINATION BRANCH PANELBOARDS**

Branch Circuit Panelboards: Fusible switch type with current limiting Class J time delay or equivalent protection.

The panelboard and overcurrent devices contained within shall be fully-rated.

Enclosure: [Type 1.] [Type 3R.] [\_\_\_\_.] Minimum cabinet size: 5-3/4 inches (144 mm) deep; 20 inches (508 mm) wide with 5" minimum gutter space top and bottom. Constructed of galvanized code gauge steel. Panel enclosure (back box) shall be of non-stamped type (without KO's) to avoid concentric break out problem.

Provide [flush] [surface] cabinet front with concealed trim clamps, concealed hinge and flush cylinder lock all keyed alike. Front cover shall be hinged to allow access to wiring gutters without removal of panel trim. Hinged trim shall be held in place with screw fasteners. Finish in manufacturer's standard gray enamel.

Provide metal directory holders with clear plastic covers. Holder to be factory mounted.

Provide panelboards with copper bus (phase buses, bus fingers, etc.), ratings as scheduled on Drawings. Provide ground bars in all panelboards. Phase, neutral and ground bar terminations can be dual rated ALCU9. All spaces shall have bus fully extended and drilled for the future installation of devices.

Overcurrent devices shall be fused branch disconnects including compact base and fuse holder in common enclosure with the following features:

Current limiting Class J time delay or equivalent protection.

Single handle common trip, 1-, 2-, and 3 pole versions.

Bolt on type.

Local open fuse indication.

UL listed for type and temperature rating of wire specified.

Permanently installed integrated lockout/tag out provisions.

600V AC rated.

Surge Protective Device: Provide a surge protective device meeting the requirements of specification section 26 43 13.

The consultant shall review age and condition of existing panelboards and availability of factory new circuit breakers. If new circuit breakers are no longer manufactured and available due to age, the Retrofit panelboard option shall be considered by Design team in existing building where traditional panelboard replacement is not a practical option due to existing conditions such as existing flush mounted panelboards. This design option shall be discussed with DFD electrical reviewer prior to implementation.

**RETROFIT PANELBOARDS**

Lighting and Appliance Branch Circuit MLO Panelboards: Circuit breaker type.

The panelboard and overcurrent devices contained within shall be **fully-rated.**

Provide metal directory holders with clear plastic covers. Holder to be factory mounted.

Provide panelboards with copper bus (phase buses, bus fingers, etc.), ratings as scheduled on Drawings.

Provide ground bars in all panelboards. Phase, neutral and ground bar terminations can be dual rated ALCU9. All spaces shall have bus fully extended and drilled for the future installation of breakers.

Minimum System (i.e. individual component) Short Circuit Rating: As shown on the Drawings and as required by short circuit/ coordination study.

Molded Case Circuit Breakers: Bolt‑on type thermal magnetic trip circuit breakers. Provide UL Class A ground fault interrupter circuit breakers where shown on Drawings. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

The manufacturer of the panelboard shall be the manufacturer of the major components within the assembly, including circuit breakers and fusible switches.

The panelboard shall be specifically designed for retrofit applications in existing panelboard boxes. The manufacturer shall supply in advance to the consultant complete application instructions and information on the panelboards.

The retrofit panelboards shall be UL listed, labeled, and tested to meet the heat rise and short circuit current requirements when installed in 4½” deep, Minimum 14.25” wide enclosure.

Basis of design is Cutler-Hammer Pow-R-Line 1R. Other manufacturers will be accepted if UL67 listed for installation into an existing back box. Alternatively, product will be accepted if contractor provides field evaluation by UL personnel of interior and back box combination and equivalency is established.

Interiors shall be completely factory assembled devices. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.

Trims for retrofit panelboards shall be designed specifically for retrofit applications. Trim mounting shall not be dependent nor attached to the existing enclosure. Trims shall have concealed hardware. Trims for branch circuit panelboards shall be supplied with a hinged door over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semi flush cylinder lock and catch assembly. Doors over 48 inches in height shall have auxiliary fasteners.

The panelboard shall be provided with an integrated depth adjustment mechanism as part of the assembly that includes depth markings for use by the installer.

Surface trims shall be same height and width as box. Flush trims shall overlap the box by 3/4 of an inch on all sides.

Enclosures shall be identified for retrofit suitability in advance. The structural integrity of all existing enclosures shall be verified. Any enclosure that is damaged shall be replaced with a new enclosure and panelboard.

Existing enclosures shall have a minimum width of 14.25 inches and a minimum depth of 4½ inches. Minimum gutter space shall be verified and shall be in accordance with the National Electrical Code.

**COORDINATION OF OVERCURRENT PROTECTIVE DEVICES**

Provide a coordination study of the electrical system and recommend set points for all of the overcurrent and ground fault trip adjustments on the equipment provided. The coordination study and set point recommendations shall be submitted to the consulting engineer for approval. Submittal shall be on or before date of switchboard and panelboard equipment submittal. The study shall meet the requirements of specification section 26 05 73.

**PART 3 - EXECUTION**

**INSTALLATION**

See section 26 05 29 for support requirements.

Install panelboards plumb with wall finishes.

Height:

Power Distribution panelboards: Minimum 12” above finished floor and maximum of 6’-7” to center of the grip of the operating handle of the top most mounted switch or circuit breaker, when at its highest position.

Branch panelboards: 6’-0” to top of panelboard.

Install a crimp type stud termination to stranded conductor when terminating on circuit breakers without a captive assembly rated for terminating stranded conductors.

Provide filler plates for unused spaces in panelboards.

See section 26 05 53 for identification requirements. Provide typed circuit directory for each panelboard per NEC 408.4(A). Revise directory to reflect circuiting changes required to balance phase loads.

Stub three (3) empty ¾” conduits to accessible location above ceiling or below floor out of each recessed panelboard. Cap these conduits to prevent material from entering them.

**FIELD QUALITY CONTROL**

If aluminum conductors sized #1/0 and larger (per Section 26 05 19) are to be used as panelboard feeders, it is the responsibility of the contractor to provide panelboards with adequate wire bending space to accommodate the aluminum conductors and terminators to meet allowable code requirements.

The Contractor shall circuit the panelboards as shown on the drawings. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 10 percent, rearrange circuits in the panelboard to balance the phase loads within 10 percent.

Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections.

**CONSTRUCTION VERIFICATION**

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 26 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

# AGENCY TRAINING

All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01 or 01 91 02.

END OF SECTION