This master should be used by designers working on Port of Portland construction projects and by designers working for PDX tenants (“Tenants”). Usage notes highlight a few specific editing choices, however the entire section should be evaluated and edited to fit specific project needs.

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1. GENERAL
	* + 1. DESCRIPTION
				1. Provide switches as indicated on the drawings, in the specifications and where required by the National Electrical Code, even though not indicated. Provide fused or non-fused switches as shown on the drawings and as required by equipment manufacturer or circuit requirements.
				2. This section describes the following individually mounted, enclosed switches and circuit breakers:

Edit below to suit project.

Fusible switches.

Nonfusible switches.

Molded-case circuit breakers.

Molded-case switches.

Low-voltage and current-limiting fuses

Enclosures.

* + - 1. RELATED WORK SPECIFIED ELSEWHERE
				1. Section 260529, Hangers and Supports for Electrical Systems
				2. Section 260553, Identification for Electrical Systems
			2. DEFINITIONS

Retain appropriate abbreviations.

* + - * 1. GFCI: Ground-fault circuit interrupter.
				2. HD: Heavy duty.
				3. RMS: Root mean square.
				4. SPDT: Single pole, double throw.
			1. REFERENCES
				1. CFR: Code of Federal Regulations

29 CFR 1910.7: Definition and Requirements for a Nationally Recognized Testing Laboratory

* + - * 1. NEC: National Electric Code
				2. NECA: National Electrical Contractors Association

NECA 1: Standard Practice of Good Workmanship in Electrical Construction

* + - * 1. NEMA: National Electrical Manufacturers Association

NEMA FU 1: Low-Voltage Cartridge Fuses

NEMA PB 1.1: General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 V or Less

NEMA PB 2.1: General Instructions for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 V or Less

* + - * 1. NETA: International Electrical Testing Association

NETA ATS: Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

* + - * 1. NFPA: National Fire Protection Association

NFPA 70: National Electric Code

* + - * 1. OR-OSHA: Oregon Occupational Safety and Health Administration
				2. UL: Underwriters Laboratories

UL 198C: Standard for Safety for High-Interrupting-Capacity Fuses, Current-Limiting Types

UL 198D: Class K Fuses

UL 198E: Class R Fuses

UL 198H: Class T Fuses

* + - 1. SUBMITTALS
				1. Product Data: Submit for each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers’ technical data on features, performance, electrical characteristics, ratings, and finishes.

Enclosure types and details for types other than NEMA 250, Type 1.

Current and voltage ratings.

Short-circuit current rating.

UL listing for series rating of installed devices.

Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

* + - * 1. Field quality-control test reports including the following:

Test procedures used.

Test results that comply with requirements.

Results of failed tests and corrective action taken to achieve test results that comply with requirements.

* + - * 1. Operation and Maintenance Data: Include data for enclosed switches and circuit breakers in operation and maintenance manuals. In addition to items specified in Division 01, include the following:

Manufacturer’s written instructions for testing and adjusting enclosed switches and circuit breakers.

Time-current curves, including selectable ranges for each type of circuit breaker.

* + - 1. QUALITY ASSURANCE

Retain subparagraph and associated subparagraph below if required for project.

* + - * 1. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OR-OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

Testing Agency’s Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

* + - * 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
				2. Comply with NFPA 70.
				3. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
1. PRODUCTS
	* + 1. FUSIBLE AND NON-FUSIBLE SWITCHES
				1. Acceptable Manufacturers:

General Electric Co., Electrical Distribution & Control Division.

Siemens Energy & Automation, Inc.

Square D/Group Schneider.

Eaton Cutler-Hammer.

Pre-bid approved equal.

* + - * 1. Fusible Switch: NEMA KS 1, Type HD, quick-make, quick-break, dual-rated with electrical characteristics as required by the system voltage and the load served. Include clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
				2. Nonfusible Switch: NEMA KS 1, Type HD, quick-make, quick-break, dual-rated with electrical characteristics as required by the system voltage and the load served. Include lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
			1. MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES
				1. Acceptable Manufacturers:

General Electric Co., Electrical Distribution & Control Division.

Siemens Energy & Automation, Inc.

Square D/Group Schneider.

Eaton Cutler-Hammer.

Pre-bid approved equal.

* + - * 1. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

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.

Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

Instantaneous trip.

Long- and short-time pickup levels.

Long- and short-time time adjustments.

Ground-fault pickup level, time delay, and I2t response.

GFCI Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity.

* + - * 1. Molded-Case Circuit-Breaker Features and Accessories:

Standard frame sizes, trip ratings, and number of poles.

Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and conductor material.

Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

* + - * 1. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
				2. Molded-Case Switch Accessories:

Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and material of conductors.

Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.

Auxiliary Switch: One SPDT switch with “a” and “b” contacts; “a” contacts mimic circuit-breaker contacts, “b” contacts operate in reverse of circuit-breaker contacts.

* + - 1. Low-voltage and current-limiting fuses
				1. Conform to NEMA FU 1. Time delay and non-time delay options shall be as shown on the drawings.
				2. Provide equipment with a complete set of properly rated fuses when the equipment manufacturer utilizes fuses in the manufacture of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed.
				3. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and shall have the time-current characteristics required for effective power system coordination.

Edit types, as appropriate; remove brackets.

* + - * 1. Cartridge Fuses: Cartridge fuses, current-limiting type, Class [G] [J] [K] [L] [RK1] [RK5] [RK9] [T] [CC] shall have tested interrupting capacity not less than [100,000] [200,000] amperes. Fuse holders shall be the type that will reject Class H fuses.

Class [G] [J] [L] [CC] fuses shall conform to UL 198C.

Class K fuses shall conform to UL 198D.

Class R fuses shall conform to UL 198E.

Class T fuses shall conform to UL 198H.

* + - * 1. Transformer Circuit Fuses: Transformer circuit fuses shall be Class RK1 or RK5, current-limiting, time-delay with 200,000 amperes interrupting capacity.
			1. ENCLOSURES
				1. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

Outdoor Locations: NEMA 250, Type 3R.

Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

1. EXECUTION
	* + 1. EXAMINATION
				1. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
				2. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. CONCRETE BASES
				1. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.
				2. Concrete base is specified in Section 260529 and concrete materials and installation requirements are specified in Division 03.
			3. INSTALLATION
				1. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
				2. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
				3. Comply with mounting and anchoring requirements specified in Section 260529.
				4. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
			4. IDENTIFICATION
				1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 260553.
				2. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Section 260533.
			5. FIELD QUALITY CONTROL
				1. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
				2. Prepare for acceptance testing as follows:

Inspect mechanical and electrical connections.

Verify switch and relay type and labeling verification.

Verify rating of installed fuses.

Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer’s certification.

Retain one of two paragraphs below. Coordinate testing agency requirements with similar requirements for switchgear, switchboards, and other electrical distribution equipment.

* + - * 1. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
				2. Perform the following field tests and inspections and prepare test reports:

Retain subparagraph below if seismic criteria apply or if anchorage device testing is required by Section 260529, Hangers and Supports for Electrical Systems.

Test mounting and anchorage devices according to requirements in Section 260529.

Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

Retain subparagraph and associated subparagraphs below if required for project.

Infrared Scanning:

Initial Infrared Scanning: After substantial completion, but not more than 60 days after final acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Open or remove doors or panels so connections are accessible to portable scanner.

Follow-Up Infrared Scanning: Perform an additional follow-up infrared scan of each unit 11 months after date of substantial completion.

Instruments, Equipment and Reports:

Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

Prepare a certified report that identifies enclosed switches and circuit breakers included and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

* + - 1. ADJUSTING
				1. Set field-adjustable switches and circuit-breaker trip ranges.
			2. CLEANING
				1. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
				2. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 262816