

LOW-VOLTAGE SERVICE ENTRANCE SWITCHBOARDS
SECTION 16428-D

SECTION 16428D (26 24 13.01)
LOW VOLTAGE SWITCHBOARDS
TYPE POW-R-LINE C 600 VAC MAXIMUM

PART 1 GENERAL

1.01 SCOPE

- A. The contractor shall furnish and install where indicated on the drawings a dead front type, low-voltage service entrance (or non-service entrance) switchboard, combining a main breaker (or fusible switch), utility metering transformer compartment (where required) and distribution feeder section(s) in a switchboard assembly. The switchboard to be built in factory in single switchboard sections, to be assembled on site, by the contractor.

1.02 RELATED SECTIONS

- A. Section 16671A – Surge Protective Devices (SPD's)
- B. Section 16475 - Circuit Breakers and Fusible Switches
- C. Section 16901 – Microprocessor Based Metering Equipment
- D. Section 16901 – Microprocessor-Based Metering Equipment – PXMP/ PXBCM
- E. Section 16429C – Generator Quick Connect Switchboards
- F. Section 16433 – Integrated Facilities Switchboards (IFS)
- G. Sections 16496A, B, C, D, E – Automatic Transfer Switches

1.03 REFERENCES

- A. The low voltage switchboard assembly and all components shall be designed, manufactured, and tested in accordance with the latest applicable following standards:
- 1. CSA C22.2 No. 244 or No. 31 (Switchboards)
 - 2. CSA C22.2 No. 5 (Moulded Case Circuit Breakers)
 - 3. CSA C22.2 No. 4 (Dead Front Switches)
 - 4. ANSI C37.13 (Power Circuit Breakers)
 - 5. ANSI C37.17 (Trip Devices)

LOW-VOLTAGE SERVICE ENTRANCE SWITCHBOARDS
SECTION 16428-D

1.04 SUBMITTALS - FOR REVIEW / APPROVAL

- A. The following information shall be submitted to the Engineer.
 - 1. Specification Sheet
 - 2. Layout Sheet - Front view and plan view of the assembly
 - 3. Single Line diagram.
 - 4. Schematic diagram (where required).
 - 5. Component List.
 - 6. Floor plan with conduit/cable space locations.
 - 7. Assembly ratings including:
 - a. Short circuit rating
 - b. Voltage class
 - c. Continuous current rating
 - 8. Major component ratings including:
 - a. Voltage class
 - b. Continuous current
 - c. Interrupting ratings
 - 9. Cable lug/termination sizes
- B. Submit ten (10) copies of the above information.

1.05 SUBMITTALS - FOR INFORMATION

- A. When requested by the Engineer the following product information shall be submitted:
 - 1. Descriptive bulletins
 - 2. Product Sheets

LOW-VOLTAGE SERVICE ENTRANCE SWITCHBOARDS
SECTION 16428-D

1.06 SUBMITTALS - FOR CLOSE-OUT

- A. The following information shall be submitted for record purposes prior to final payment.
 - 1. Final as-built drawings for items listed in section 1.04.
 - 2. Wiring diagrams (where applicable).
 - 3. Installation information including equipment anchorage provisions.
- B. Submit ten (10) copies of the above information.
- C. The final as-built drawings shall include the same drawings as the construction drawings and shall incorporate all changes made during the manufacturing process.

1.07 QUALIFICATIONS

- A. The manufacturer of the assembly shall be the manufacturer of the moulded case breakers, fusible switches and/or power circuit breakers installed within the assembly.
- B. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this request.
- C. * Provide Seismic qualified equipment, when required, as follows:
 - 1. The equipment and major components shall be suitable for and certified to meet all applicable seismic requirements of the [latest National Building Code of Canada (NBCC)] .
 - 2. The Project Structural Engineer will provide site specific ground motion criteria for use by the manufacturer to establish Sa (0.2) value required.
 - 3. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.
 - a. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed engineer in the province. Mounting recommendations shall be provided by the manufacturer based upon the above criteria to verify the seismic design of the equipment.
 - b. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.

LOW-VOLTAGE SERVICE ENTRANCE SWITCHBOARDS
SECTION 16428-D

- c. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.08 REGULATORY REQUIREMENTS

- A. The switchboard shall comply with the latest standard CSA C22.2 No. 244, or No. 31. The assembly shall bear a CSA label. All devices and components contained in this switchboard shall bear a CSA label and comply with the latest issue of their respective CSA standard. All power circuit breakers shall meet ANSI C37.13 and be CSA certified for use in the assembly.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.
- B. Each switchgear assembly shall be split into shipping groups for handling as determined during the shop drawing phase jointly with the installing contractor. Shipping groups shall be designed to be shipped by truck, rail or ship. Shipping groups shall be bolted to skids, and covered with tarps for protection from weather. Accessories shall be packaged separately.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton
- B. _____
- C. _____

2.02 RATINGS

- A. Voltage rating shall be as indicated on the drawings. The entire assembly shall be suitable for ¹[240][480][600] volts maximum service.
- B. The service panel bus shall be rated ¹[800][1200][1600][2000][2500][3000][4000][5000][6000] amperes.
- C. The assembly shall be rated, type tested and CSA listed to withstand a short circuit of ¹[42,000][65,000][85,000][100,000][130,000][200,000] amperes symmetrical tested in accordance with CSA C22.2 No. 244, or No. 31.

¹Note to Spec Writer-Select One

LOW-VOLTAGE SERVICE ENTRANCE SWITCHBOARDS
SECTION 16428-D

- D. All bussing shall be ¹[tin plated aluminum][silver plated copper] [tin plated copper] and braced as per short circuit requirements of 2.02 (C) above. Bus sizing shall be based on CSA standard temperature rise criteria of 65 degrees C over a 40 degree C ambient (outside the enclosure).
1. Provide a full capacity neutral bus where a neutral bus is indicated on the drawings.
 2. A copper ground bus (minimum 1/4 x 2 inch) shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard.
 3. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with conical spring-type washers.

2.03 CONSTRUCTION

The service entrance switchboard shall be ¹[TYPE 1][TYPE 2] [Sprinklerproof per CEC 26-008][TYPE 3R] enclosed, and fabricated from code gauge steel complete with formed doors to form a rigid dead front, totally enclosed structure. The service entrance switchboard shall be free standing.

Where required, all compartments are to be designed to make components totally front accessible to enable the switchboard to be installed against the wall.

For custom applications, Rear Access and Side Access configurations are available.

Isolation barriers shall be provided to separate the main disconnect device and the utility current/potential transformer section. The distribution section(s) / cell(s) shall be separately barriered and isolated from the main service entrance section. Ventilation shall be provided to meet CSA temperature rise requirements. Where a sprinklerproof switchboard is supplied, ventilation shall not compromise sprinklerproof rule 26-008 of the Canadian Electrical Code.

All structures and covers are to be painted ¹[ASA-61 Grey] ²_____ (special colour).

Size: Each Structure, 90" high x ¹[38"][48"] wide x ²_____ deep (18" minimum & 90" Maximum).

The switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. Provision shall be made for additional structures as required to accommodate future additions.

2.04 WIRING/TERMINATIONS

- A. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

LOW-VOLTAGE SERVICE ENTRANCE SWITCHBOARDS
SECTION 16428-D

- B. NEMA 2-hole ¹[mechanical-] [crimp-] type lugs shall be provided for all line side terminations suitable for copper or aluminum cable rated for 75 degrees C of the size indicated on the drawings.
- C. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the drawings.
- D. All control wire shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

2.05 MAIN BREAKER (** select device as appropriate**)

The main breaker shall be an Eaton moulded case type ²_____, _____A (2500A maximum) with RMS sensing ¹[electronic][standard thermal magnetic] trip unit. Changing the breaker's continuous rating shall be accomplished by the use of a mechanically interlocked rating plug, or adjustment of Long Delay Pick-up setting, with no exposure to live parts (trip unit on standard thermal magnetic breaker may be changed, however all power to switchboard must be disconnected prior to removal of breaker cover). The breaker's interrupting rating shall be ²_____ kA RMS Symmetrical at ²_____ V (see Section 16475).

-¹OR-

The main breaker shall be an Eaton Power Circuit Breaker type Magnum DS, ²_____A (6000A maximum) with Digitrip [¹520][520M][520MC] [1150+] trip unit with ¹[LS][LSI][LSIA][LSIG] protection. The breaker's interrupting rating shall be ²_____ kA RMS Symmetrical at ²_____ V (see Section 16475). The breaker shall be fixed mount or draw-out as indicated on the drawings. Accessories shall be plug-in type and viewable from the front of the breaker. Magnum DS breaker shall be manually operated, or electrically operated, as specified. (see Section 16475)

-¹OR-

2.06 MAIN FUSIBLE SWITCH (*select main switch to a maximum of 3000A*)

The main switch shall be an Eaton type FDPW up to 1200A or Bolted Pressure Contact type switch (Pringle) up to 3000A. The main switch plus fuses shall have an interrupting rating equal to ¹[100 kA at 600VAc][200kA at 240VAc].

The main ¹[breaker][switch] section shall be complete with provisions for padlocking the main ¹[breaker][switch] and compartment door. A removable disconnect link to ground the neutral, the service conduit, and the system ground must be supplied. (see Section 16475)

2.07 UTILITY METERING TRANSFORMER COMPARTMENT

When requested, the utility transformer compartment shall be designed to meet the local utility requirements. It shall be bussed and pre-drilled to **accept**

LOW-VOLTAGE SERVICE ENTRANCE SWITCHBOARDS
SECTION 16428-D

standard bar type and/or window type current transformers. The compartment shall have a hinged, padlockable access door.

2.08 DISTRIBUTION SECTION - GROUP (CHASSIS) MOUNTED

The distribution section shall be designed to accept the installation of circuit breakers and/or fusible switches or fusible meter switches, type FSMC (fusible switch meter sockets) on an Eaton Pow-R-Line 4 type interior. Any space not occupied by a feeder breaker or switch shall have a filler plate allowing no access to parts when energized.

Each full height distribution cubicle shall accommodate 50X of vertical distribution space suitable for use with both moulded case circuit breakers and/or fusible switches. Standard distribution cubicle dimensions shall be 90" high X ¹[38"][48"] wide x ²_____ deep (**18"** minimum & 90" Maximum).

Each full height distribution cubicle shall accommodate 42X of vertical distribution space suitable for use with fusible meter switches, type FSMC (fusible switch meter sockets). Standard distribution cubicle dimensions shall be 90" high X [48"] wide x ²_____ deep (**18"** minimum & 90" Maximum).

¹[Feeder breakers shall be supplied as shown on the single line drawings. Interrupting capacity of feeder breakers shall be ²_____ kA RMS Symmetrical at ²_____ VAc.][Feeder switches shall be supplied as shown on the single line drawings. Interrupting capacity of feeder switches shall be ²_____ kA RMS Symmetrical at ²_____ VAc when supplied with HRC ¹[J][R][T] fuses.]

2.09 OPTIONAL FEEDER DRAWOUT MOULDED CASE CIRCUIT BREAKERS - GROUP (CHASSIS MOUNTED) OR INDIVIDUALLY MOUNTED

A. Molded Case Circuit Breakers shall come complete with draw-out feature. Draw-out cassette shall consist of two separate components:

Moveable mechanism, which is attached to the breaker.

-600A Maximum frame size. IC up to 65ka at 600v, 200ka at 240V.

Stationary mechanism, which houses the cassette.

-Cassettes can be custom bussed in a switchboard assembly, or mounted on a PRL4 distribution chassis in the switchboard.

B. Features of the draw-out cassette shall include:

Interlock system will not allow the breaker to be connected or disconnected while in the ON position.

LOW-VOLTAGE SERVICE ENTRANCE SWITCHBOARDS
SECTION 16428-D

Secondary Terminal Block - If required, the draw-out cassette includes a secondary terminal block for wiring of low voltage accessories, such as shunt trip, undervoltage release, auxiliary contacts, zone selective interlocking, neutral sensor.

C. The draw-out mechanism shall have three positions:

1. Connected - The breaker is fully connected to the primary stabs and secondary terminal block (when supplied).
2. Disconnected - Both the primary stabs and the secondary terminal block (when supplied) are disconnected. A racking handle inserts into the racking port through the dead front cover. A position indicator, viewable through the dead front cover, indicates the position of the breaker.
3. Withdrawn - The breaker can be removed from the cassette. Two handles on dead front cover allow for easy breaker removal.

D. Additional safety features to be included:

No requirement to remove covers, or disconnect cables, to remove or insert a breaker.

Safety mesh surrounds the cassette inside the switchboard to prevent objects from falling into the cassette.

Clear cover is provided over cable lugs, when the breaker is removed to prevent contact with lugs.

Optional IR viewing windows are available in front of cable lugs and line side connections of cassette.

Optional key interlocks are available.

2.10 OPTIONAL FEEDER POWER CIRCUIT BREAKERS – MAGNUM DS – INDIVIDUALLY MOUNTED

The Feeder breaker shall be an Eaton Power Circuit Breaker type Magnum DS, ² _____ A (5000A maximum) with Digitrip [¹520][520M][520MC] [1150+] trip unit with [¹LS][LSI][LSIA][LSIG] protection. The breaker's interrupting rating shall be ² _____ kA RMS Symmetrical at ² _____ V (see Section 16475). The breaker shall be fixed mount or draw-out as indicated on the drawings. Accessories shall be plug-in type and viewable from the front of the breaker. Magnum DS breaker shall be manually operated, or electrically operated, as specified. (see Section 16475)

2.11 OPTIONAL FEEDER BOLTED CONTACT PRESSURE SWITCHES – PRINGLE – INDIVIDUALLY MOUNTED

Feeder Bolted Contact Pressure Fusible Switches shall be available up to 3000A. See Section 16475 for further details.

LOW-VOLTAGE SERVICE ENTRANCE SWITCHBOARDS
SECTION 16428-D

2.12 MISCELLANEOUS DEVICES

- A. Key interlocks shall be provided as indicated on the drawings.
- B. Control power transformers with primary and secondary protection shall be provided, as indicated on the drawings, or as required for proper operation of the equipment. ☒[Control power transformers shall have adequate capacity to supply power to the transformer cooling fans.]
- C. ☒Each section of the switchboard shall be provided with a space heater ☒[thermostatically controlled]. Power for the space heaters shall be obtained ☒[from a control power transformer within the switchboard] [from a source as indicated on the drawings]. Supply voltage shall be ☒[120] [240] volts AC.

2.12 CUSTOMER METERING

- A. Where indicated on the drawings, provide a separate customer metering compartment with a front facing hinged door and include the following:
- B. Current transformers for each meter. Current transformers shall be wired to shorting-type terminal blocks.
- C. ☒[Potential transformers including primary and secondary fuses with disconnecting means] [Fused potential taps as the potential source] for metering as shown on the drawings.

2.13 OPTIONAL ENCLOSURE

- ☒Outdoor NEMA 3R Enclosure
- 1. Outdoor enclosure shall be non-walk-in and meet applicable NEMA 3R CSA requirements
- 2. Enclosure shall have [sloping roof downward toward rear]
- 3. Outer sections shall be the same widths as indoor structures, except each end of the outdoor assembly shall have an end trim
- 4. The enclosure shall be provided with ☒[bolt-on rear covers] [rear hinged doors] for each section
- 5. Doors shall have provisions for padlocking
- 6. Ventilating openings shall be provided ☒[complete with replaceable fiber glass air filters]
- 7. Provide space heaters ☒[thermostatically controlled] for each structure with adequate wattage to prevent the accumulation of moisture
- 8. Power for space heaters, lights and receptacles shall be obtained from a ☒[control power transformer within the switchboard] [source as indicated on the drawings]. Supply voltage shall be ☒[120] [240] volts AC

2.14 NAMEPLATES

☒Note to Spec. Writer – Optional

☒ Note to Spec. Writer – Select one

LOW-VOLTAGE SERVICE ENTRANCE SWITCHBOARDS
SECTION 16428-D

- A. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, black characters on white background. Characters shall be 3/16-inch high, minimum. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish master nameplate giving switchboard designation, voltage ampere rating, short-circuit rating, manufacturer's name, general order number, and item number.
- B. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

LOW-VOLTAGE SERVICE ENTRANCE SWITCHBOARDS
SECTION 16428-D

2.15 FINISH

- A. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be ASA 61 light gray.

2.16 OPTIONAL FEATURES

Sprinklerhood, 3" overhang standard, optional longer overhang is available

200% rated neutral bus

Ground Fault on Main Breaker or Fusible Switch (refer to Section 16475)

Customer or Revenue Metering per Section 16901.

Remote Communication

Base Channels

Door over distribution panel

Conduit/cable gland mounting Plates (aluminum / fibre)

Hydro stub / collector bus

Provision for Bus Duct Entry

Incoming Wireway (unbussed / bussed)

Transformer coordination

Surge Protective Device per Section 16671A


Special protective relaying, special metering, special ground fault annunciation/ relaying schemes, IR viewing windows, shall be provided as defined in separate specifications.

¹Note to Spec Writer-Select One


LOW-VOLTAGE SERVICE ENTRANCE SWITCHBOARDS
SECTION 16428-D

PART 3 EXECUTION

3.01 FACTORY TESTING

- A. The switchboard shall be completely assembled, wired, adjusted and tested at the factory. After assembly, the complete switchgear shall be tested to ensure the accuracy of the wiring and the functioning of all equipment. The main bus system shall be given a dielectric test of 2200 volts for one minute between live parts and ground and between opposite polarities. See switchgear spec
- B. The wiring and control circuits shall be given a dielectric test of 1500 volts for one minute between live parts and ground, in accordance with CSA standards.
- C. A certified test report of all standard production tests shall be shipped with each assembly.
- D.  Factory test as outlined above shall be witnessed by the owner's representative.
 - 1. The manufacturer shall notify the owner two (2) weeks prior to the date the tests are to be performed
 - 2. The cost of transportation, lodging, meals and incidental expenses shall be the owner's responsibility

3.02 FIELD QUALITY CONTROL


- A. Provide the services of a qualified factory-trained manufacturer's representative to assist the Contractor in installation and start-up of the equipment specified under this section for a period of  _____ working days. The manufacturer's representative shall provide technical direction and assistance to the contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein.
- B. The Contractor shall provide three (3) copies of the manufacturer's field startup report.

3.03 MANUFACTURER'S CERTIFICATION

- A. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.
- B. The Contractor shall provide three (3) copies of the manufacturer's representative's certification before final payment.

3.04 TRAINING

LOW-VOLTAGE SERVICE ENTRANCE SWITCHBOARDS
SECTION 16428-D

- A. The Contractor shall provide a training session for up to five (5) owner's representatives for  _____ normal workdays at a job site location determined by the owner.
- B. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of the instruction on the operation of the assembly, circuit breakers, and major components within the assembly.

3.05 FIELD SERVICE ORGANIZATION

- A. The manufacturer of the Switchgear shall also have a national service organization that is available throughout Canada and is available on call 24 hours a day, 365 days a year.
- B. Equipment warranty shall be extended to two years from date of installation when service representatives employed by the equipment manufacturer perform installation.

3.06 INSTALLATION

- A. The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.
- B. All necessary hardware to secure the assembly in place shall be provided by the Contractor.
- C. The equipment shall be installed and checked in accordance with the manufacturer's recommendations. This shall include but not limited to:
 - 1. Checking to ensure that the pad location is level to within 0.125 inches per three foot of distance in any direction
 - 2. Checking to ensure that all bus bars are torqued to the manufacturer's recommendations
 - 3. Assembling all shipping sections, removing all shipping braces and connecting all shipping split mechanical and electrical connections
 - 4. Securing assemblies to foundation or floor channels
 - 5. Measuring and recording Megger readings phase-to-phase, phase-to-ground, and neutral-to-ground (four wire systems only)
 - 6. Inspecting and installing all circuit breakers in their proper compartments