

SECTION 16433 (26 24 13.03)

SWITCHBOARDS – LOW VOLTAGE (INTEGRATED FACILITIES SWITCHBOARDS – IFS)

PART 1 GENERAL

1.01 SCOPE

- A. The [Contractor] [Owner] shall furnish and install, where indicated, a free-standing, dead-front type low-voltage distribution switchboard, utilizing group mounted circuit protective devices, integrated panelboards, and other equipment as specified herein, and as shown on the contract drawings.

1.02 RELATED SECTIONS

- A. Section 16147A, B, C, & D – Lighting Control System
- B. Section 16470 – Panelboards
- C. Section 16147 – Lighting Control Panelboard
- D. Section 16147E – Intelligent Panelboard for Lighting and Energy Management
- E. Section 16475 – Circuit Breakers and Fusible Switches – Low Voltage
- F. Section 16496A, 16496C – Automatic Transfer Switches – Low Voltage
- G. Section 16671A – Transient Voltage Surge Suppression
- H. Section 16901 – Microprocessor-Based Metering Equipment
- I. Section 16904 – Microprocessor Trip Units for Low-Voltage Circuit Breakers
- J. Section 16264A, B, C, D, E, & F – Uninterruptible Power Supply (UPS)
- K. Section 16429C – Generator Quick Connect Switchboard
- L. Section _____ – Data/Com Racks

1.03 REFERENCES

- A. The low-voltage distribution switchboards and all components shall be designed, manufactured and tested in accordance with the latest applicable following standards:
 - 1. CSA C22.2 No.31

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)

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5. Component list
 6. Conduit entry/exit locations
 7. Assembly ratings including:
 - a. Short-circuit rating
 - b. Voltage
 - c. Continuous current
 8. Major component ratings including:
 - a. Voltage
 - b. Continuous current
 - c. Interrupting ratings
 9. Cable terminal sizes
 10. Product data sheets
- B. Where applicable, the following additional information shall be submitted to the Engineer:
1. Busway connection
 2. Connection details between close-coupled assemblies
 3. Composite floor plan of close-coupled assemblies
 4. Key interlock scheme drawing and sequence of operations


1.05 SUBMITTALS – FOR CONSTRUCTION

- A. The following information shall be submitted for record purposes:
1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
 2. Wiring diagrams
 3. Certified production test reports
 4. Installation information
 5. Seismic certification and equipment anchorage details as specified

1.06 QUALIFICATIONS

- A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- C. 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 requirement.
- D. ~~☞~~ 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)] .

~~☞~~ Note to Spec. Writer - Optional

2. The Project Structural Engineer will provide site specific ground motion criteria for use by the manufacturer to establish S_a (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.
 - 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.
- E.  Eaton has been pre-selected by the owner. Substitutions will not be considered. All costs associated with equipment other than specified are the sole responsibility of the Contractor and request for reimbursement of those costs will be rejected as non-compliant.

1.07 REGULATORY REQUIREMENTS

- A. The low-voltage switchboard shall be CSA labeled.

1.08 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.

1.09 OPERATION AND MAINTENANCE MANUALS


- A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

PART 2 PRODUCTS

2.01 MANUFACTURERS

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

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the

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specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.02 RATINGS

- A. The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current ~~☐~~[of ~~☐~~(35,000) (65,000) (100,000) amperes symmetrical at rated voltage] [as shown on the drawings]. Main Switchboard Section shall be fully rated for ~~☐~~[(35,000), (65,000) or (100,000)] amperes symmetrical at rated voltage. Sub-panels shall be ~~☐~~ [fully] [series] rated to meet requirements shown on drawings. Copies of series combinations shall be submitted with approval drawings. These series combinations are required to be tested by CSA and values predicted by the use of let-through curves are not acceptable.
- B. Voltage rating to be as indicated on the drawings.

2.03 CONSTRUCTION

- A. Switchboard shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.
- B. All sections of the switchboard shall be ~~☐~~[rear] [front and rear] aligned with depth as shown on the drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front accessible enabling switchboard to be mounted against a wall.
- C. ~~☒~~The switchboard shall be of one-piece, bolted together construction, up to 35 feet in length and include a top mounted lifting bracket.

-- ~~☐~~OR --

- A. All sections of the switchboard shall be ~~☐~~[rear] [front and rear] aligned with depth as shown on drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front and rear accessible. Rear access shall be provided.
- B. The assembly shall be provided with adequate lifting means.
- C. The switchboard shall be equal to Eaton type Pow-R-Line C utilizing the components herein specified and as shown on the drawings.
- D. ~~☒~~The switchboard shall be suitable for use as service entrance equipment and be labeled in accordance with CSA requirements.

2.04 BUS

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- A. All bus bars shall be ~~☐~~ [silver-plated copper] [tin-plated aluminum]. Main horizontal bus bars, if applicable, shall be mounted with all three phases arranged in the same vertical plane. Bus sizing shall be based on NEMA standard temperature rise criteria of 65 degrees C over a 40 degrees C ambient (outside the enclosure).
- B. Provide a full capacity neutral bus where a neutral bus is indicated on the drawings.
- C. 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.
- D. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with conical spring-type washers.

2.05 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.
- B. Mechanical-type terminals shall be provided for all line and load terminations suitable for copper or aluminum cable rated for 75 degrees C of the size as 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.
- E. Where there is a main switchboard section in the lineup, the switchboard manufacturer shall wire from the associated feeder breaker to the respective panelboard, dry type distribution transformer, automatic transfer switch, UPS, etc... as noted on drawings. Feeders shall be copper, and conductor sized as noted on the drawings.

2.06 MAIN SWITCHBOARD SECTION

Note to Spec Writer:

Select main, tie and feeder device spec from Section 16475 as indicated and insert under A, B, C and D as follows:

Power Circuit Breakers – Magnum DS

Insulated Case Breakers – Magnum SB

Molded Case Circuit Breakers –
1200 A and Below

Molded Case Circuit Breakers –
Above 1200 A

Bolted Pressure Switches

Fusible Switches

Select trip units for the selected breaker type, from Section 16904

- A. Main ⌘[and tie] protective devices
- B. Trip units – Main and Tie devices
- C. Feeder protective devices
- D. Trip units – Feeder devices
- E. Accessories
 1. Provide shunt trips, bell alarms and auxiliary switches as shown on the contract drawings.
 2. Individual molded case circuit breaker energy monitoring - refer to spec 16901.

2.07 INTEGRATED PANELBOARDS

- A. The switchboard manufacturer shall integrate and assemble panelboards into the switchboard as shown on the contract drawings. Each panelboard shall contain a trim with lockable door. The panel shall be recessed in the switchboard enclosure a minimum of four inches from the front of the switchboard to allow easy access to line and/or load conductors entering/exiting top of bottom. Trim doors shall be laser cut to assure proper fit. Three quarter inch (3/4-inch) breakers shall not be used in any part of the panelboard.
- B. The Switchboard shall accommodate two (2) 42-circuit panelboards (225-Amp Main Circuit Breaker or 400-Amp Main Lug Only) per structure, or one, half-height molded case breaker distribution chassis and one (1) 42-circuit panelboard.
- C. Integrated panelboards shall be equal to Eaton Pow-R-Line type. Ratings of the panelboards shall meet marked ratings of the switchboard.
- D. Panelboards shall meet criteria as shown in Section 16470.
- E. Panelboards shall have a wire management system in side wire way to accommodate branch circuit wiring passing through vertically in that section.
- F. ⌘Panelboards shall have [bolted cover] [door-in-door] trims.

2.08 ⌘ENVIRONMENTAL AND LIGHTING CONTROLS

⌘ Note to Spec. Writer – Optional

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- A. The switchboard manufacturer shall integrate approved environmental control systems and components into the switchboard assembly.
- B. The switchboard manufacturer shall integrate lighting control systems and components into the switchboard assembly. The lighting control system shall be as specified in Section 16147.

2.09 ⚡ DRY-TYPE DISTRIBUTION TRANSFORMERS

- A. The switchboard manufacturer as shown on the contract drawings shall integrate and assemble dry-type distribution transformers into the switchboard. The transformer shall be secured in a manner that assures the structural integrity of the vertical switchboard section and the transformer. Adequate ventilation for the transformer and other installed components shall be provided within the switchboard. Transformer shall be high-efficiency NEMA type TP-1 Energy Star labeled. Other specialty transformers are available such as K factor, harmonic mitigating, or low-noise, etc., as shown on drawings.
- B. If the primary breaker is located in the same assembly, the switchboard-manufacturer shall wire the transformer from the feeder over-current device to the primary side of the transformer in accordance with CSA utilizing copper conductors. The switchboard manufacturer shall wire the secondary side of the transformer to the load or panelboard shown on the drawings in accordance with CSA and the Canadian Electrical Code. Dry-type distribution transformers shall meet criteria as shown in Section 16461 as required.
- C. The switchboard shall accommodate up to 225kVA dry type distribution transformer mounted standalone in one full height structure or up to 150-kVA dry type distribution transformer in one-half height structure with a feeder breaker distribution chassis above.
- D. Additional configurations are available – contact Eaton.
- E. Designs with transformers in a stacked configuration in one structure will not be accepted.


2.10 ⚡ LOW VOLTAGE AUTOMATIC TRANSFER SWITCHES

- A. The switchboard manufacturer shall integrate low voltage automatic transfer switches into the switchboard assembly where shown on the drawings.
- B. The low voltage automatic transfer switches shall be as specified in Section 16496A or 16496C.

2.11 ⚡ UNINTERRUPTIBLE POWER SUPPLIES

- A. The switchboard manufacturer shall integrate uninterruptible power supply into the switchboard assembly where shown on the drawings.
- B. The uninterruptible power supply shall be as specified in Section 16244.

2.12 ⚡ DATACOM RACKS

- A. The switchboard manufacturer shall integrate Data Com racks into the switchboard assembly where shown on the drawings.
- B. The Data Com rack shall be as specified in Section  _____.

⚡ Note to Spec. Writer – Optional

2.13 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 unit substation 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.

2.14 ☒ UTILITY METERING

- A. Where indicated on the drawings, furnish a barrier to separate the utility metering compartment complete with hinged sealable door. Bus work shall include provisions for mounting utility company current transformers and potential transformers or potential taps as required by the utility company. Provide service entrance label and provide necessary applicable service entrance features per CEC and local code requirements.

2.15 ☒ OWNER METERING

- A. Where indicated on the drawings, provide a separate owner metering compartment with front 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.
 - D. Microprocessor-Based Metering System – Refer to Section 16901.
 - E. ☒ Web-Enabled Communications
 - 1. Where indicated on the drawings, provide a separate compartment with a front facing hinged door as a central point of connection for all internally located communicating devices to an external Ethernet network and allow close monitoring of the power infrastructure with real-time, web-enabled data.
 - 2. The included communications components shall be a [Power Xpert Ethernet Switch(es)] [Power Xpert Gateway(s)], which [is] [are] specified in Section 16911-1 (should specify paragraphs in the section).
 - 3. ☒ Communication system shall be Eaton PowerXpert Architecture

2.16 ENCLOSURES

- A. ☒ NEMA 1 Enclosure

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B. •Outdoor NEMA 3R Enclosure

1. Outdoor enclosure shall be non-walk-in and meet applicable NEMA 3R CSA requirements
2. Enclosure shall have Sloped roof [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 fiberglass 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

2.17 NAMEPLATES

- 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.

2.18 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 ANSI 61 light gray.

2.19 %SURGE PROTECTIVE DEVICES

- A. Provide surge protective devices as specified in Section 16671A.

PART 3 EXECUTION

3.01 FACTORY TESTING

• Note to Spec. Writer – Select one

% Note to Spec. Writer – Optional

- A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of CSA standards.
 - 1. The switchboard shall be completely assembled, wired, adjusted, and tested at the factory. After assembly, the complete switchboard will be tested for operation under simulated service conditions to assure the accuracy of the wiring and the functioning of all equipment. The main circuits shall be given a dielectric test of 2200 volts for one (1) minute between live parts and ground, and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for one (1) minute between live parts and ground
- B. The manufacturer shall provide three (3) certified copies of factory test reports.

3.02 MANUFACTURER'S CERTIFICATION

- A. ✂ A certified test report of all standard production tests shall be available to the Engineer upon request.

3.03 ✂ TRAINING

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

3.04 INSTALLATION

- A. The Contractors shall install all equipment per the manufacturer's instructions, contract drawings and Canadian Electrical Code.
- B. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to [Contractor supplied floor sills to be set level in concrete per manufacturer's recommendations] [the floor without the use of floor sills provided the floor is level to 1/8 inch per 3-foot distance in any direction]. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

3.05 FIELD ADJUSTMENTS

- A. The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short-circuit study, protective device evaluation study and protective device coordination study.
- B. Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with an approved short circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the owner.

3.06 FIELD SERVICE ORGANIZATION

✂ Note to Spec. Writer – Optional

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- 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.