1. GENERAL

1.01 SECTION INCLUDES

.1 Power distribution panelboards – Circuit breaker type.

.2 Lighting and appliance branch circuit panelboards.

1.02 RELATED REQUIREMENTS

.1 Section 26 28 16.02 – Molded Case Circuit Breakers.

.2 [Section 26 43 13 – Surge Protective Devices for Low-Voltage Electrical Power Circuits: externally mounted surge protective devices.]

1.03 REFERENCES

.1 CSA Group:

.1 CSA C22.1:21, Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.2 Ontario Electrical Safety Code (28th edition/2021).

.3 CSA C22.2 No. 5-16 – Molded Case Circuit Breakers, molded-case switches, and circuit-breaker enclosures.

.4 CSA C22.2 No. 29-15 – Panelboards and Enclosed Panelboards.

.2 NEMA:

.1 NEMA ICS 2-2000 (R2020) – Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 volts.

.2 NEMA KS 1-2013 – Heavy Duty Enclosed and Dead-Front Switches (600 volts Maximum).

.3 NEMA PB 1-2011 – Panelboards.

.4 NEMA PB 1.1-2013 – General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 volts or Less.

.3 NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association).

1.04 SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Work of this Section is to be submitted for review after Consultant's review of Coordination Study per Section 26 05 73.16 is completed.

.3 Shop drawings shall contain overall panelboard dimensions, interior mounting dimensions, and wiring gutter dimensions. The location of the main, branches, and solid neutral shall be clearly shown. In addition, the drawing shall illustrate one line diagrams with applicable voltage systems.

.4 Shop drawings:

.1 Indicate the following:

.1 Outline and support point dimensions.

.2 Voltage.

.3 Main bus ampacity.

.4 Integrated short circuit ampere rating.

.5 Circuit breaker arrangement, types, and sizes.

.2 The following information shall be submitted to the Consultant:

.1 Breaker layout drawing with dimensions indicated and nameplate designation.

.2 Component list.

.3 Conduit entry/exit locations.

.4 Assembly ratings including:

.1 Short-circuit rating.

.2 Voltage.

.3 Continuous current.

.5 Cable terminal sizes.

.6 Product data sheets.

.3 Where applicable, the following additional information shall be submitted to the Consultant:

.1 Key interlock scheme drawing and sequence of operations.

.5 Submittals for Construction

.1 The following information shall be submitted for record purposes:

.1 Installation information.

1.05 CLOSEOUT SUBMITTALS

.1 Refer to Section 01 78 00.

.2 Record actual locations of panelboards and record actual circuiting arrangements in project record documents.

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

.4 Final as-built drawings and information shall incorporate all changes made during the manufacturing and installation process.

.5 Include a copy of each panelboard schedule in the Operation and Maintenance manual.

1.06 MAINTENANCE MATERIAL SUBMITTALS

.1 Manufacturer shall provide installation instructions and NEMA Standards Publication PB 1.1 – Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 volts or Less.

.2 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.

.3 Provide two of each panelboard key.

.4 Provide final panelboard schedules indicating panelboard data, phasing, breaker sizes, and loads served.

1.07 QUALITY ASSURANCE

.1 Regulatory Requirements

.1 Products: Listed and classified by CSA (Canadian Standards Association).

.2 Qualifications

.1 Company specializing in manufacturing of panelboard products with a minimum of 20 years' experience.

.2 The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

.3 For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

.4 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Consultant, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.08 DELIVERY, STORAGE, AND HANDLING

.1 Inspect and report concealed damage to carrier within their required time period.

.2 Handle carefully to avoid damage to panelboard internal components, enclosure, and finish.

.3 Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional heavy canvas or heavy plastic cover to protect enclosure(s) from dirt, water, construction debris, and traffic.

.4 Equipment shall be handled and stored in accordance with manufacturer's instructions. One copy of these instructions shall be included with the equipment at time of shipment.

1.09 WARRANTY

.1 Warrant specified equipment to be free from defects in materials and workmanship for eighteen (18) months from the date of purchase.

2. PRODUCTS

2.01 GENERAL

.1 Description: CSA C22.2 No. 29, circuit breaker type.

2.02 DISTRIBUTION PANELBOARDS – CIRCUIT BREAKER TYPE

.1 Manufacturers:

.1 Square D by Schneider Electric, I-LINE Series.

.2 Eaton Cutler-Hammer, PRL 3 and PRL4 Series.

.3 Equal by Siemens.

.2 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 specification and manufactured by others not named will be considered only if pre-approved by the Consultant ten days prior to bid date.

.3 Panelboard Bus:

.1 Copper, ratings as indicated.

.2 Provide copper neutral bus for panelboards indicated for 4-wire systems.

.3 Provide copper ground bus in each panelboard.

.4 Short Circuit Ratings:

.1 Panelboards rated 600 V shall have minimum integrated short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 65 000 amperes RMS symmetrical.

.2 Distribution panelboards with bolt-on devices contained therein shall have interrupting ratings as specified herein or indicated on the drawings.

.3 Panelboards shall be fully rated.

.4 Where indicated, provide circuit breakers ULC listed for application at 100 per cent of their continuous ampere rating in their intended enclosure.

.5 Minimum integrated short circuit rating: Panelboards rated 240 V shall have minimum integrated short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 10 000 amperes RMS symmetrical.

.6 Molded Case Circuit Breakers: To Section 26 28 16.02.

.7 Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.

.8 Cabinet Front: Surface type, fastened hinge and latch, metal directory frame, finished in manufacturer's standard gray enamel.

.9 Enclosures: CSA type 2 sprinklerproof complete with drip hood, or as noted.

.10 Trims shall be equipped with a flush lock.

.11 Breaker positions labeled as “Spare” or “Space” shall constitute no less than 20 per cent of available breaker positions, whether indicated or not in panelboard schedules.

.12 Each panel shall be complete with a directory which shall be mounted inside door in a metal frame with clear plastic cover and copy in each Data Book. Use final Room Numbers for directories.

2.03 BRANCH CIRCUIT PANELBOARDS

.1 Manufacturers:

.1 Square D by Schneider Electric, NQ or NQOD Series.

.2 Eaton Cutler-Hammer, POW-R-LINE 1, POW-R-LINE 2, POW-R-LINE 3 Series.

.3 Equal by Siemens.

.2 Description: CSA C22.2 No.29, circuit breaker type, lighting and appliance branch circuit panelboard.

.3 Panelboard Bus:

.1 Copper, ratings as indicated.

.2 Provide copper neutral bus in each panelboard.

.3 Provide copper ground bus in each panelboard.

.4 Provide insulated ground bus where scheduled.

.4 Minimum Integrated Short Circuit Rating: 10 000 amperes RMS symmetrical for 240 V panelboards, or as indicated.

.5 Molded Case Circuit Breakers: NEMA AB 1, plug-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.

.6 Current Limiting Molded Case Circuit Breakers where indicated: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

.7 Cabinet Front: Surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

.8 Enclosure shall be CSA type 2 sprinklerproof complete with drip hood, or as noted.

.9 Trims shall be equipped with a flush lock.

.10 Breaker positions labeled as “Spare” or “Space” shall constitute no less than 20 per cent of available breaker positions, whether indicated or not in panelboard schedules.

.11 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.12 Panelboards rated 240 VAC or less shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 10,000 amperes RMS symmetrical.

.13 Bus and breakers rated for symmetrical interrupting capacity, as indicated.

.14 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.15 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.16 Two keys for each panelboard and key panelboards alike.

.17 Copper bus with neutral of same ampere rating as mains.

.18 Mains: suitable for bolt-on breakers.

.19 Trim with concealed front bolts and hinges.

.20 Trim and door finish: baked grey enamel.

.21 The minimum short-circuit rating for branch circuit panelboards shall be as specified herein or as indicated on the drawings. Panelboards shall be fully rated.

.22 Bolt-on type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.

.23 Circuit breakers shall be thermal-magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100 A frame and through 100 A trip sizes shall take up the same pole spacing. Circuit breakers shall be ULC listed as type SWD for lighting circuits.

.1 Circuit breaker handle locks shall be provided for all circuits that supply exit signs, emergency lights, energy management, and control system (EMCS) panels and fire alarm panels.

.24 Circuit breakers shall have a minimum interrupting rating of 10 000 A symmetrical at 240 V, and 14 000 amperes symmetrical at 480 V, unless otherwise noted on the drawings.

.25 Each panel shall be complete with a directory which shall be mounted inside door in a metal frame with clear plastic cover and copy in each Data Book. Use final Room Numbers for directories.

.26 Panels shall be dead front type in code gauge steel enclosures. All panels shall be sprinkler proof c/w drip hoods as required.

.27 Panels shall have mains of voltage and capacity, and main and branch breakers, as shown on the drawings. Spaces shall include necessary bus work such that Owners, at a later date, need buy only the breakers.

.28 [Where branch circuit metering is used on a panelboard, provide 762 mm (30") tub width to accommodate the metering devices within the panelboard.]

.29 Where panels exceed 42 circuits, use multi-section panel with main cross-over solid bus bars unless noted otherwise on drawings. Main bus capacity of each section shall be full size to match cross-over bus.

.30 Breakers shall have bolted type connections. Multi-pole breakers shall be common trip type with a single handle, suitable for voltage applied and of same manufacture as single pole breakers.

.31 Panels for 120/208 V, 3-phase, 4-wire systems shall be complete with full size breakers.

.32 Where shown on drawings or required by code, certain breakers shall include ground fault interrupter.

.33 Provide lighting and receptacle panels suitable for surface, or flush-mounting type, as shown.

.34 Provide locking bars on non-switched circuits where panels are used for switching lighting circuits.

.35 Panels for non-linear loads shall be complete with lugs for double neutrals.

.36 Panels shall be given a rust-resistant treatment to both tub and trim.

.37 Flush panels shall have concealed hinges and flush type combination lock latch. Locks shall be chrome plated. Doors shall open minimum

135 degrees. Trims shall have fasteners concealed and shall be prime coated to receive room finish paint.

.38 Surface mounted panels shall have manufacturer's standard surface door trim complete with lock and latch. Finish shall be grey.

.39 Recessed panels shall have standard flush trims.

.40 Co-ordinate panel finish with Room Finish Schedule.

2.04 MOLDED CASE CIRCUIT BREAKERS

.1 Breakers: to Section 26 28 16.02.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Lock-on devices for 10 per cent of 15 A to 30 A breakers installed as indicated. Turn over unused lock-on devices to Owner.

.5 Lock-on devices for fire alarm, security, and sprinkler circuits.

.6 Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

.7 Provide breakers for externally mounted Surge Protective Devices in accordance with Section 26 43 13.

2.05 CONSTRUCTION

.1 General:

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

.2 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.

.3 A temporary directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.

.4 All locks shall be keyed alike.

.2 Branch Circuit Panelboards:

.1 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. Door-in-door trim shall be provided. Both hinged trim and trim door shall utilize three point latching. No tools shall be required to install or remove trim. Trim shall be equipped with a door-actuated trim locking tab. Equip locking tab with provision for a screw such that removal of trim requires a tool, at the owner's option. Installation shall be tamper resistant with no exposed hardware on the panelboard trim.

.3 Distribution Panelboards:

.1 Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.

2.06 BUS

.1 Lugs: Copper and listed by CSA, or cUL, for use with copper conductors and sized to accept copper conductors of the ampacity specified.

.2 Main bus bars shall be copper sized in accordance with CSA standards to limit temperature rise on any current carrying part to a maximum of 65°C above an ambient of 40°C maximum.

.3 A copper system ground bus shall be included in all panelboards.

.4 Full-size (100 per cent rated) insulated copper neutral bars shall be included for panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection. 200 per cent rated neutrals shall be supplied for panels designated on drawings with oversized neutral conductors.

2.07 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 53.

.2 Nameplate for each panelboard size 4 engraved.

.3 Nameplate for each branch circuit in distribution panelboards size 2 engraved.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

.5 Provide an engraved nameplate for each panelboard section.

.6 Provide copies of all circuit directories in manuals.

2.08 SOURCE QUALITY CONTROL

.1 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 NEMA and CSA standards.

3. EXECUTION

3.01 INSTALLATION

.1 Install panelboards to CSA C22.1.

.2 Install panelboards plumb.

.3 Height: 1800 mm to top of panelboard; install panelboards taller than 1800 mm with bottom no more than 100 mm above floor.

.4 Provide filler plates for unused spaces in panelboards.

.5 Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

.6 Provide engraved plastic nameplates under the provisions of Section 26 05 53.

.7 Ground and bond panelboard enclosure according to Section 26 05 26.

.8 Locate panelboards as indicated and mount securely, plumb, true, and square, to adjoining surfaces.

.9 Install surface mounted panelboards on fire rated plywood backboards in accordance with Section 26 05 29. Where practical, group panelboards on common backboard.

.10 Connect loads to circuits.

.11 Connect neutral conductors to common neutral bus with respective neutral identified.

.12 Deliver five (5) duplicate keys for each panel lock to the Owner.

.13 Mount electrical panels, where possible, with top of trim at uniform height of 2000 mm.

.14 Cap ends of conduits in accessible locations in ceiling spaces above panels, to allow for future wiring.

.15 The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

.16 Install panelboards in accordance with manufacturer's written instructions, NEMA PB 1.1 and Electrical Code requirements.

.17 After completion of wiring, type directory showing a clear description of each circuit being controlled from panel and place in metal frame inside door.

.18 Provide circuit breaker handle locks for all circuits that supply exit signs, emergency lights, energy management, and control system (EMCS) panels and fire alarm panels.

.19 [Provide three 27 mm empty conduits from top of lighting, receptacle, telephone, signal and communication panels recessed in walls, to ceiling space.]

3.02 FIELD QUALITY CONTROL

.1 Perform inspections and tests listed in NETA ATS, Section 7.4 for switches, Section 7.5 for circuit breakers.

.2 Inspect complete installation for physical damage, proper alignment, anchorage, and grounding.

.3 Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads within 20 per cent of each other. Maintain proper phasing for multi-wire branch circuits.

.4 Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

3.03 ADJUSTING

.1 Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other.

.2 Maintain proper phasing for multi-wire branch circuits.

End of Section