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SECTION 26 05 00
COMMON WORK RESULTS ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

.1 This Section covers items common to all Electrical sections and is intended only to supplement the requirements of Division 01.

.2 This Section shall be considered as an augmentation to Section 07 84 00 Firestopping and any or all sub sections of Section 07 84 00.

.3 Provide seismic restraints for required equipment, lighting and conduit.

.4 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by BCIT.

.5 Coordinate Work with other Sections, and determine extent and character of related work to ensure complete installation.

1.2 RELATED SECTIONS

.1 07 84 00 Firestopping.

.2 26 05 53 Identification for Electrical Systems.

1.3 REFERENCES

.1 British Columbia Building Code, 2012 Edition or the latest edition (BCBC).

.2 CSA C22.1-15 Canadian electrical code, part I (23rd edition), safety standard for electrical installations, Update No. 1 (2015) or the latest edition.

.3 CAN3-C235-83(R2005) or latest edition. Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.4 IEEE SP1122-2000 The Authoritative Dictionary of IEEE Standards Terms, 7th Edition or latest edition.

.5 ULC 115 Standard Method of Fire Tests of Firestop Systems (CAN/ULC S115-11).

.6 Underwriters Laboratories, Inc. (cUL) – Fire Resistance Directory of Products Certified for use in Canada.

1.4 DEFINITIONS

.1 “Provide” is defined as “supply, install, test and commission, for the products and services specified.”

.2 “As Indicated” is defined as: that the item(s) specified are shown on the drawings.

.3 “Install” is defined as: all work and materials necessary to place the specified item into full operation, securely fastened, and to give a presentable finished appearance. “Install” also includes all necessary connections and conductors.

.4 “Coordinate” is defined as: to make all arrangements directly with agencies and individuals, confirm schedules, be in attendance at the time work is being carried out, and take full responsibility for having the work carried out correctly and in a timely manner to meet the construction schedule.

.5 Reference to “Electrical Divisions” shall mean all sections of Divisions 26, 27, 28, 33, 34, and 48 in the Master Format of the Canadian Master Specifications.

.6 “Standard of Acceptance” means that the item named and specified by the manufacturer and/or catalogue number forms part of the specification and sets standard regarding performance, quality of material and workmanship and when used in conjunction with a reference standard, shall be deemed to supplement the standard.

.7 A visible manufacturer’s nameplate shall indicate manufacturer’s name, model number, serial number, capacity data, electrical characteristics and approval stamps.

1.5 DESIGN REQUIREMENTS

.1 Access Panels and Doors: Provide Installer with installation instructions for panels, doors or frames.

.2 Backboards: Use fire-retardant backboards, pressure impregnated with fire-retardant chemicals, and stamp. Conform to CSA 080.

.3 Cutting and Patching: Contractor shall employ trades for required cutting, patching and repairing of surfaces for work.

.4 Ensure equipment does not transmit noise and/or vibration to other parts of building as a result of poor installation practices.

.5 Firestopping: Include labour, materials, and equipment necessary for complete installation for firestopping of through penetrations in fire rated assemblies.

.6 Operating Instructions: Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel. Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Follow procedures in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.6 Post instructions where directed.

.7 Perform required floor saw cutting and drilling for electrical services within hours established by BCIT. Provide prior written notice of 48 hours to BCIT.

.8 Prior to interrupting major services, notify BCIT in advance and arrange acceptable schedule for the interruptions.

.9 Prior to interrupting any services, complete all preparatory work as far as reasonably possible and ensure necessary materials are on site and pre-fabricated (where practical). Ensure length of interruption is kept to a minimum.

.10 Provide fire barriers around components in holes which penetrate fire separations. Ensure fire barrier medium makes fire separation equal to or better than the one cut away. Materials shall be CSA approved and UL listed.

.11 Provide published certified ratings for materials, equipment and plant, specified design, performance, quality, and current models to ensure availability of replacement parts.

.12 Protect existing services encountered. Obtain instructions from Engineer where existing services require relocation or modification.

.13 Provide project management and on-site supervision to undertake administration, meet schedules, ensure timely performance and coordination for orderly completion and delivery of fully commissioned installation.

.14 Refinish damaged or marred factory finish to factory finish.

.15 Seismic Analysis and Provisions:

.1 Install electrical systems with adequate structural support to withstand seismic forces in accordance with Section 4.1.8 of the National Building Code, and Province and Municipality.

.2 Indicate equipment in the structural design documents and include, but not limited to: suspended transformers, bus ducts, cable trays, suspended conduit runs, free standing distribution equipment such as switchboards and motor control centres, and suspended luminaires.

.3 Refer to seismic risk reduction of operational and functional components (OFCs) of building S832-06 and meet all requirements.

.4 All luminaires shall be provided with independent chain supports that are fastened to the structure of the Building.

.16 Sprinkler Proof Requirements: Where sprinkler fire protection systems are installed, equipment and wiring systems shall be sprinkler proof standard.

.17 System Start-up:

.1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

1.6 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 Submittal Procedures.

.2 Product Data: Submit WHMIS MSDS in accordance with Section 01 47 15 Sustainable Requirements.

.3 Shop Drawings:

.1 Submit Drawings stamped and signed by a professional engineer registered, or licensed in Province of British Columbia.

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, wiring, conduit, and other items necessary to ensure coordinated installation.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate clearances for operation, maintenance, and replacement of operating equipment devices on Drawings.

.5 Submit number of copies of drawings and product data indicated in Submittals Section 01 33 00, to the Authority Having Jurisdiction.

1.7 QUALITY ASSURANCE

.1 Provide the following in accordance with Section 01 45 00 Quality Control.

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and materials are not available, submit such equipment and material to inspection authorities for special approval prior to delivery to site.

.3 Test results: Submit test results of installed electrical systems and instrumentation and the report shall be stamped and signed by a professional engineer registered, or licensed in Province of British Columbia.

.4 Seismic certificate including Letters of Assurance shall be stamped and signed by a professional seismic engineer registered, or licensed in Province of British Columbia.

.5 Permits and fees: Submit in accordance with General Conditions of contract.

.6 Load Balance Report: Submit upon completion of Work, as described in PART 3 - LOAD BALANCE.

.7 Certificate of Acceptance from Authority Having Jurisdiction: Submit upon completion of Work.

.2 Where CSA certified material and equipment are not available, obtain special approval from inspection authorities before delivery to site and include such approval with Shop Drawing, as described in PART 1 - SUBMITTALS.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials according to manufacturer’s printed instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Disposal and recycling of fluorescent lamps as per local regulations.

.4 Divert unused metal materials from landfill to metal recycling facility.

1.9 WARRANTY

.1 Use of installed equipment during construction shall not shorten or alter the warranty period, as specified in Division 01.

.2 Take note of any extended warranties specified.

.3 Furnish a written warranty stating that all work executed under this Division will be free from defects of material and workmanship for a period of one (1) year from the date of substantial performance.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00 Common Product Requirements.

.2 Material and equipment to be CSA certified.

.3 Labels: Lamacoid Type:

.1 Normal Power: Black background, white lettering.

.2 Emergency Power: Red background, white lettering.

.4 Backboards:

.1 Provide plywood backboard (G1S) for all electrical rooms, communication rooms and security rooms as indicated.

.1 Where no size is indicated, provide a backboard a minimum of 100 mm wider and 100 mm higher than the equipment.

.2 Where more than one piece of equipment is installed on the backboard, construct the backboard of a size to suit the maximum vertical and horizontal dimensions of equipment.

.3 For communication and security rooms where not indicated, provide backboard for all surfaces in communication and security rooms.

.4 Backboard shall extend from finished floor to 8’ AFF, continuously around the communication and security rooms, or as indicated.

.5 Construct plywood backboards from 199 mm thick fir plywood (FSC to UF Free) good one side.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Uncrate equipment, move in place and install complete; start up and test. Include all field assembly of loosely/separately packaged accessories.

.2 Perform complete installation in accordance with CSA C22.1 except where specified otherwise.

.3 Ensure overhead and underground systems are in accordance with CSA C22.3 No.1 except where specified otherwise.

.4 Access Panels and Doors:

.1 Install access doors to match the building material grids where applicable.

.2 Ensure proper fire rating of access doors in fire separations.

.3 Install concealed electrical equipment requiring adjustment or maintenance in locations easily accessible through access panels or doors.

.4 Install systems and components to result in a minimum number of access panels. Indicate access panels on “Record” drawings.

.5 Nameplates and Labels: Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

.6 Location of Devices:

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.7 Mounting Heights:

.1 Ensure mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 Where mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1400 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 Above top of counters or counter splash backs: 175 mm.

.4 In mechanical rooms: 1400 mm.

.3 Panelboards: 1800 mm to top or as required by Code or as indicated.

.4 Communications outlets: 300 mm.

.5 Wall mounted telephone and interphone outlets: 1500 mm.

.6 Doorbell pushbuttons: 1500 mm.

.7 Fire alarm manual stations: not less than 1200 mm and not more than 1400 mm to centre of device.

.8 Fire alarm bells: not less than 2300 mm and shall maintain 150 mm clearance from the ceiling.

.9 Fire Visible Signal Device: not less than 2000 mm and not more than 2400 mm of the entire lens.

.10 Fire fighter handset: not less than 1350 mm and not more than 1500 mm to centre of device.

.11 Fire alarm end of line resistors: less than 1800 mm to centre of device.

.12 Annunciator: not more than 1800 mm to top of display.

.13 Wall-mounted emergency lighting heads: 2.35 m.

3.2 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance.

.2 Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.3 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.4 Provide load balance report as directed in PART 1 – SUBMITTALS upon completion of work:

.1 Phase and neutral currents on panelboards.

.2 Dry-core transformers and motor control centres.

.3 Operating under normal load.

.4 Hour and date on which each load was measured

.5 Voltage at time of test.

.2 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project. Carry out tests in presence of Engineer. Test the following:

.1 Power generation and distribution system including phasing, voltage, grounding and load balancing.

.2 Touch and Step Voltage for High Voltage system.

.3 Generator and UPS commissioning test.

.4 Circuits originating from branch distribution panels.

.5 Lighting and its control.

.6 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.7 Fire alarm systems.

.8 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350 – 600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

3.3 CLOSEOUT ACTIVITIES

.1 Record Drawings:

.1 Obtain two (2) sets of white prints for the sole purpose of recording changes in installation as they occur. One (1) set is to be used in the field for day-to-day recording, and one (1) set for submittal after completion.

.2 Keep plans up-to-date as changes occur.

.3 Arrange and pay for incorporation of any “”as-built” changes to reproducible plans.

END OF SECTION

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SECTION 26 05 21
WIRES AND CABLES (0 -1000 V)

PART 1 - GENERAL

1.1 SUMMARY

.1 Materials and installation for Wires and Cables (0 – 1,000 V).

1.2 RELATED SECTIONS

.1 26 05 00 Common Work Results for Electrical.

1.3 REFERENCES

.1 British Columbia Building Code, 2012 Edition or latest edition (BCBC) .

.2 CSA C22.1-15 Canadian electrical code, part I (23rd edition), safety standard for electrical installations, Update No. 1 (2015) or latest edition.

1.4 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer’s printed product literature, specifications and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 47 15 Sustainable Requirements: Construction and Section 02 81 01 Hazardous Materials and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish

.3 Shop Drawings:

.1 Submit Shop Drawings in accordance with Section 26 05 00 Common Work Results for Electrical.

.4 Closeout Submittals:

.1 Provide maintenance data for materials for incorporation into manual specified in Section 01 78 00 Closeout Submittals.

.2 Data necessary for maintenance of materials.

1.5 DELIVERY STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Building Wires:

.1 Conductors: Stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: Sized as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, non-jacketed.

.2 Teck 90 Cable:

.1 Cable shall be in accordance with Section 26 05 00 Common Work Results for Electrical. Teck cable to be used only where permitted by BCIT.

.2 Conductors:

.1 Grounding conductor: Copper as indicated.

.2 Circuit conductors: Copper, as indicated, size as indicated.

.3 Insulation:

.1 Ethylene propylene rubber EP.

.2 Cross-linked polyethylene XLPE.

.3 Rating shall be 600 V.

.4 Inner jacket: Polyvinyl chloride material.

.5 Armour: Interlocking.

.6 Overall covering: Thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.

.7 Fastenings: One-hole aluminum straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.8 Connectors: Watertight, approved for Teck cable.

.3 Armoured Cables:

.1 Conductors: Insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: Interlocking type fabricated from aluminum strip.

.4 Connectors: Anti-short connectors.

.4 3 Phase AC - All Voltages: Cable colours as follows:

.1 Phase A: Red.

.2 Phase B: Black.

.3 Phase C: Blue.

.4 Neutral: White.

.5 Bond: Green.

.6 Ground: Green.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 General Cables:

.1 Service power wiring: Rated 600 Volts RW90 X-link. Install in conduit.

.2 Minimum wire size: No. 12 AWG, size wires for 2% maximum voltage drop to the farthest outlet on a loaded circuit.

.3 Home runs: to 120 Volt circuits which exceed 23m (75’-0”) in length: No. 10 AWG.

.4 Home runs which exceed 38 m (125’-0”) in length: Minimum No. 8 AWG.

.2 Teck 90 Cable: Group cables wherever possible on channels.

.3 Armoured Cables: Group cables wherever possible mounted on channels

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 Common Work Results for Electrical.

.2 Perform tests including insulation test, continuity test and voltage drop test before energizing electrical system.

END OF SECTION

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SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS (LABELING)

PART 1 - GENERAL

1.1 SUMMARY

.1 This Section covers items common to all electrical Sections and is intended only to supplement the requirements of Division 01.

.2 Provide labels for required electrical equipment such as switchboards, motor control centres, generators, distribution panels, disconnects, transformers etec

1.2 RELATED SECTIONS

.1 01 61 00 Common Product Requirements.

.2 26 05 00 Common Work Results - Electrical.

1.3 REFERENCES

.1 CSA C22.1-15 Canadian electrical code, part I (23rd edition), safety standard for electrical installations, Update No. 1 (2015) or the latest edition.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00 Common Product Requirements.

.2 Material and equipment to be CSA certified.

.3 Labels: Lamacoid Type:

.1 Normal Power: Black background, white lettering.

.2 Emergency Power: Red background, white lettering.

PART 3 - EXECUTION

3.1 EQUIPMENT IDENTIFICATION

.1 Label shall contain the following information:

.1 Panel

(Floor)		(Voltage)		(Standard Power)		(Panel)		(Panel Name)		(Lighting)
2	-	2	-	S	-	P	-	A	-	L

.1 Example
a) Third Floor : 347/600V Emergency Power Panel (3-3E-P-A-P)
b) Fourth Floor : 120/208V Standard Power & Lighting Panel (4-2S-P-A-PL)

.2 Distribution

(Floor) (Voltage) (Standard Power) (Distribution) (Distribution Name) (Lighting)

2 - 2 - S - D - A - L

.1 Example
a) Third Floor : 347/600V Emergency Power Distribution (3-3E-D-A-P)
b) Fourth Floor : 120/208V Standard Power & Lighting Panel (4-2S-D-A-PL)

.3 Motor Control Panel (MCC)

(Floor) (Voltage) (Standard Power) (Motor Control Panel) (MCC Name)
2 - 2 - S - MCC - A

.1 Example
a) Fifth Floor : 347/600V Emergency MCC (5-6E-MCC-A)

.4 Transformer

(Floor) (Voltage) (Emergency Power) (Transformer) (Transformer Name)
2 - 2 - E - T - A

.1 Example
a) Fifth Floor : 120/208V Standard Power Transformer (5-2E-T-A)

.5 UPS

(Floor) (Voltage) (Standard Power) (UPS) (UPS Name)
2 - 2 - S - U - A

.1 Example
a) Fifth Floor : 120/208V Standard Power UPS (5-2S-U-A)

.2 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: lamicoid 3mm thick plastic engraving sheet, black finish face, white core, lettering accurately aligned and engraved into core and mechanically attached with self tapping screws.

.2 Sizes are as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.3 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.4 Wording on nameplates and labels to be approved by BCIT prior to manufacture.

.5 Allow for minimum of 25 letters per name plate and label.

.6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.7 Identify equipment with Size 3 labels engraved “ASSET INVENTORY NO. ( ) if required by BCIT

.8 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.9 Terminal cabinets and pull boxes: indicate system and voltage.

.10 Transformers: indicate capacity, primary and secondary voltages.

3.2 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

3.3 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Conduit System	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Security Systems	Red	Yellow

END OF SECTION

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SECTION 26 09 43
LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

.1 Materials and installation of low voltage lighting controls.

.2 Materials and installation of occupancy or vacancy controls.

.3 Materials and installation of multi-level or dimming controls.

.4 Provide all wiring and devices required for the installation, programming, commissioning and documents of commissioning to prove correct circuitry and performance.

.5 Provide local wall mounted switching for all lighting control. Local switching may be either line voltage or low voltage.

.6 Local Multi-Level or Dimming Switch: Provide multi-level switching or dimming for the following:

- .1 Classrooms.
- .2 Lecture Halls.
- .3 Laboratory.
- .4 Computer Lab.
- .5 Offices – Open.
- .6 Offices – Private.
- .7 Meeting Rooms.
- .8 Staff Rooms.

.7 Provide vacancy sensors in the following:

- .1 Classrooms.
- .2 Lecture Halls.
- .3 Offices – Private.
- .4 Meeting Rooms.
- .5 Staff Rooms.
- .6 Change or Locker Rooms.
- .7 Storage Rooms.
- .8 Service Rooms less than 250 ft².

.8 Provide occupancy sensors in Change Rooms, Locker Rooms and Storage Rooms.

1.2 REFERENCES

.1 British Columbia Building Code, 2012 Edition or latest edition (BCBC).

.2 CSA C22.1-15 Canadian electrical code, part I (23rd edition), safety standard for electrical installations, Update No. 1 (2015) or latest edition.

.3 ASHRAE 90.1-2010 or current adopted edition Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI Approved; IES Co-sponsored).

1.3 SYSTEM REQUIREMENTS

.1 Switches:

.1 Multi-Zone: Open areas and large rooms shall have multi-zone switching with each zone being a maximum of 2,500 ft².

.2 Where multi-level switching or dimming is provided, maintain uniformity of lighting for each lighting level.

.3 Lighting shall be turned 'ON' and 'OFF' by local switching.

.2 Low Voltage Control: BCIT has existing master lighting control system through the campus-wide Building Management System. Utilize the master lighting control wherever possible to control:

.1 Corridors.

.2 Washrooms.

.3 Entrances.

.4 Exterior lighting.

.3 Occupancy Sensors:

.1 Ensure availability of sensors using passive infrared, ultrasonic, acoustic, and multi-technology adaptive technology.

.2 Use occupancy sensors to activate lighting after hours.

.4 Vacancy Sensors:

.1 Dual technology ultrasonic and infrared sensor.

.2 In unoccupied spaces, use vacancy sensors to turn lighting 'OFF'.

1.4 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 47 15 Sustainable Requirements: Construction and Section 02 81 01 Hazardous Materials and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Indicate:

.1 Complete assembly.

.2 Contact surfaces.

.3 Construction features.

.4 Wiring diagrams.

.5 Catalogue information.

1.5 QUALITY CONTROLS SUBMITTALS

.1 Provide submittals in accordance with Section 01 45 00 Quality Control.

.2 Field Quality Control:

.1 On completion of installation, notify manufacturer's representative to carry out site review and programming for a complete and operational system.

.3 Closeout Submittals:

.1 Provide maintenance data for materials for incorporation into manual specified in Section 01 78 00 Closeout Submittals.

.2 Data necessary for maintenance of materials.

.3 Manufacturer's recommended list of spare parts.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, and address.

.3 Handle materials with suitable lifting equipment.

.4 Store materials in heated, dry, weather-protected enclosure

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Ensure control system is by a single manufacturer and assembled from compatible components

2.2 MATERIALS

.1 Integration with Building Management System (BMS).

.2 Product protocol: Native BACnet.

.3 BaCnet IP Network wiring specification: Cat 6 UTP - FT6 cable.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Daylight Sensors: Locate photo sensors to avoid cycling. Commission each sensor and adjust dead-band and set points to maximize energy savings

.2 Occupancy Sensors: Install in strict accordance with the intended detection range and pattern. Commission each sensor to eliminate "false positive" events.

.3 Vacancy Sensors:

.1 Wall mount where rooms are 300 ft^2 or less.

.2 Ceiling Mount for larger rooms.

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SECTION 26 24 13
SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

.1 Materials and installation for switchboards.

1.2 REFERENCES

.1 British Columbia Building Code, 2012 Edition or latest edition (BCBC).

.2 CSA C22.1-15 Canadian electrical code, Part 1 (23rd edition), safe standard for electrical installation, Update No. 1(2015) or latest edition

.3 CAN/CSA C22.2 No.31-14 Switchgear Assemblies.

.4 Section 26 28 16.02 Moulded Case Circuit Breaker

.5 Section 26 27 00 Power Distribution

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 47 15 Sustainable Requirements: Construction and Section 02 81 01 Hazardous Materials and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Shop Drawings:

.1 Submit Shop Drawings in accordance with Section 26 05 00 Common Work Results for Electrical.

.4 Closeout Submittals:

.1 Provide maintenance data for materials for incorporation into manual specified in Section 01 78 00 Closeout Submittals.

.2 Data necessary for maintenance of materials.

.3 Manufacturers recommended list of spare parts.

1.4 DELIVERY STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with specifications the following manufacturers are acceptable:

.1 Eaton.

.2 Schneider.

2.2 RATING

.1 Switchboard: indoor, [_____]V, [_____] A, [__] phase, [___] wire, 60 Hz, minimum short circuit [___] kA (rms symmetrical).

2.3 ENCLOSURE

.1 Main incoming section to contain:

.1 Moulded case circuit breaker with solid state trip unit (LSIG), sized as indicated.

.2 Customer digital power meter.

.3 Surge Protection Device.

.2 Distribution sections to contain:

.1 Moulded case circuit breaker with solid state trip unit, sized as indicated.

.2 Silver flashed copper bus, from main section to distribution sections including vertical bussing.

.3 Blanked off spaces for future units.

.4 Metal enclosed, free standing, floor mounted, dead front, indoor, CSA Enclosure 2, sprinkler proof cubicle unit.

.5 Ventilating louvres: Vermin, insect, sprinkler proof with easily replaceable fibre glass filters.

.6 Access from front only.

.7 Steel channel sills for base mounting in single length common to multi-cubicle switchboard.

.8 Provision for future extension.

2.4 BUSBARS

.1 [Three] phase and full capacity neutral silver flashed copper Busbars, continuous current rating [2000]A self-cooled, extending full width of multi-cubicle switch board], suitably supported on insulators.

.2 Main connections between bus and major switching component to have continuous current rating to match major switching components.

.3 Busbars and main connections: 99.30% conductivity copper.

.4 Provision for extension of bus on [left] [right] side of unit without need for further drilling or preparation in field.

.5 Silver surfaced joints, secured with non-corrosive bolts and Belleville washers.

.6 Identify phases of busbars by suitable marking.

.7 Busbar connectors, when switchboard shipped in more than one section.

2.5 GROUNDING

.1 Copper ground bus not smaller than 50 x 6 mm extending full width of multi-cubicle switchboard and situated at bottom.

.2 Lugs at each end for size 2/0 AWG grounding cable.

2.6 CIRCUIT BREAKERS

.1 Moulded case circuit breaker, bolt-on, solid state trip unit.

.2 Breaker interrupting capacity: [___] kAIC RMS symmetrical.

.3 Breaker tripping devices, solid state as indicated.

.1 Instantaneous overcurrent relays.

.2 Overvoltage relay.

.3 Undervoltage relay.

.4 Time overcurrent relay.

.5 Time-delay relay.

.6 Ground fault relay.

.4 Trip setting devices: dials.

.5 Auxiliary contacts: 2 – N.O., 2 – N.C.

.6 Provide spare parts as recommended by the manufacturer for a maintenance period of at least 2 years.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with

3.2 INSTALLATION

.1 As indicated on Drawings and in compliance with manufacturer's written recommendation or specifications, including product technical bulletins, handling, storage and installation instructions and data sheets.

3.3 CLEANING

.1 On completion and verification of performance of installation, remove surplus material, rubbish, tools and equipment.

END OF SECTION

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SECTION 26 24 16.01
PANELBOARDS BREAKER TYPE

PART 1 - GENERAL

1.1 SUMMARY

.1 Materials and installation for standard and custom breaker type panelboards.

1.2 REFERENCES

.1 British Columbia Building Code, 2012 Edition or latest edition

.2 (BCBC).

.3 CSA C22.1-15 Canadian electrical code, Part 1 (23rd edition), safe standard for electrical installation, Update No. 1(2015) or latest edition

.4 CSA C22.2 No. 29-2015 Panelboards and Enclosed Panelboards.

1.3 RELATED SECTIONS

.1 Section 26 28 16.02 Moulded Case Circuit Breakers.

.2 Section 26 27 00 Power Distribution

1.4 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer’s printed product literature, specifications and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 47 15 Sustainable Requirements: Construction and Section 02 81 01 Hazardous Materials and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Shop Drawings: Submit Shop Drawings in accordance with Section 26 05 00 Common Work Results for Electrical.

.1 Include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure type and dimension.

.4 Closeout Submittals:

.1 Provide maintenance data for materials for incorporation into manual specified in Section 01 78 00 Closeout Submittals.

.2 Data necessary for maintenance of materials.

.3 Manufacturers’ recommended list of spare parts.

1.5 DELIVERY STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with specifications the following manufacturers are acceptable:

.1 Eaton.

.2 Schneider.

2.2 MATERIALS

.1 Panelboards:

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

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

.2 250 and 600 V panelboards: Bus and breakers rated for 10 kAIC (symmetrical) interrupting capacity, or as indicated.

.3 Panelboards: Mains, number of circuits, and number and size of branch circuit breakers as indicated. Minimum panel: 42 cct with 225 A bus.

.4 Two keys for each panelboard and key panelboard alike.

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

.6 Mains: Suitable for bolt-on breakers.

.7 Trim with concealed front bolts and hinges.

.8 Trim and door finish: ASA Grey baked enamel.

.2 Breakers:

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

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

.3 Panelboard is to be filled with spare 15 A - 1P breakers.

.3 Equipment Identification:

.1 Provide equipment identification in accordance with Section 26 05 53 Identification for Electrical Systems.

.2 Nameplate for each panelboard.

.3 Nameplate for each circuit in distribution panelboards.

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

2.3 ACCESSORIES

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

.2 Lock-on devices for fire alarm, emergency, door supervisory, stairway, exit and night light circuits.

PART 3 - EXECUTION

NOT USED

END OF SECTION

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SECTION 26 27 00
POWER DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Furnish and install power distribution equipment.

.2 Power distribution equipment include, but is not limited to the following:

- .1 Switchboards.
- .2 Panelboards Switch and Fuse Type.
- .3 Fuses – Low Voltage.
- .4 Panelboards Breaker Type.
- .5 Moulded Case Circuit Breakers
- .6 Disconnect Switches – Fused and Non-Fused

1.2 REFERENCES

.1 British Columbia Building Code, 2012 Edition or latest edition (BCBC).

.2 Canadian Standards Association (CSA International).

.3 CSA C22.1-15 Canadian electrical code, part I (23rd edition), safety standard for electrical installations, Update No. 1 (2015) or latest edition.

.4 CSA C22.2 No.4-16 Enclosed and dead-front switches (Tri-National standard, with NMX-J-162-ANCE-2016 and UL 98).

.5 CSA-C22.2 No. 5-13 Molded-case circuit breakers, molded-case switches and circuit-breaker enclosures (Tri-national standard, with UL 489 and NMX-J-266-ANCE-2013), Update No. 1 (2014).

.6 CSA C22.2 No.29-15 Panelboards and Enclosed Panelboards.

.7 CAN/CSA C22.2 No.31-14 Switchgear Assemblies.

.8 CSA C22.2 No.39-13 Fuseholder Assemblies.

1.1 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 Submittal Procedures.

.2 Product Data:

- .1 Provide manufacturer's printed product literature, specifications and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 47 15 Sustainable Requirements: Construction and Section 02 81 01 Hazardous Materials and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Shop Drawings:

- .1 Submit Shop Drawings in accordance with Section 26 05 00 Common Work Results for Electrical.

.4 Closeout Submittals:

.1 Provide maintenance data for materials for incorporation into manual specified in Section 01 78 00 Closeout Submittals.

.2 Data necessary for maintenance of materials.

.3 Manufacturers recommended list of spare parts.

1.2 DELIVERY STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with specifications the following Equipment manufacturers are acceptable:

.1 Eaton.

.2 Schneider.

.2 Subject to compliance with specifications the following Fuse manufacturers are acceptable:

.1 Bussmann.

.2 Ferraz Shawmut.

.3 Littelfuse.

.4 Mersen.

2.2 MATERIALS

.1 Switchboards:

.1 Rating:

.1 Switchboard: indoor, [_____]V, [_____] A, [__] phase, [___] wire, 60 Hz, minimum short circuit [___] kA (rms symmetrical).

.2 Enclosure:

.1 Main incoming section to contain:

.1 Moulded case circuit breaker with solid state trip unit (LSIG), sized as indicated.

.2 Customer digital power meter.

.3 Transient voltage surge suppression.

.2 Distribution sections to contain:

.1 Moulded case circuit breaker with solid state trip unit, sized as indicated.

.2 Silver flashed copper bus, from main section to distribution sections including vertical bussing.

.3 Blanked off spaces for future units.

.4 Metal enclosed, free standing, floor mounted, dead front, indoor, CSA Enclosure 2, sprinkler proof cubicle unit.

.5 Ventilating louvres: vermin, insect, sprinkler proof with easily replaceable fibre glass filters.

.6 Access from front only.

.7 Steel channel sills for base mounting in single length common to multi-cubicle switchboard.

.8 Provision for future extension on [left] [right] side.

.3 Busbars:

.1 Three phase and full capacity neutral silver flashed copper Busbars, continuous current rating [2000] A self-cooled, extending full width of multi-cubicle switch board], suitably supported on insulators.

.2 Main connections between bus and major switching component to have continuous current rating to match major switching components.

.3 Busbars and main connections: 99.30% conductivity copper.

.4 Provision for extension of bus on [left] [right] side of unit without need for further drilling or preparation in field.

.5 Silver surfaced joints, secured with non-corrosive bolts and Belleville washers.

.6 Identify phases of busbars by suitable marking.

.7 Busbar connectors, when switchboard shipped in more than one section.

.4 Grounding:

.1 Copper ground bus not smaller than 50 x 6 mm extending full width of multi-cubicle switchboard and situated at bottom.

.2 Lugs at each end for size 3/0 AWG grounding cable.

.5 Circuit Breakers:

.1 Moulded case circuit breaker, bolt-on, solid state trip unit.

.2 Breaker interrupting capacity: 10kAIC RMS symmetrical.

.3 Breaker tripping devices, solid state as indicated.

.1 Instantaneous overcurrent relays.

.2 Overvoltage relay.

.3 Undervoltage relay.

.4 Time overcurrent relay.

.5 Time-delay relay.

.6 Ground fault relay.

.4 Trip setting devices: dials.

.5 Auxiliary contacts: 2 - N.O., 2 - N.C.

.6 Provide spare parts as recommended by the manufacturer for a maintenance period of at least two (2) years.

.2 Panelboards Breaker Type:

.1 Panelboards:

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

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

.2 250 and 600 V panelboards: bus and breakers rated for 10kAIC (symmetrical) interrupting capacity or as indicated.

.3 Panelboards: Mains, number of circuits, and number and size of branch circuit breakers as indicated. Minimum panel is to be 42 cct with 225 A bus.

.4 Two keys for each panelboard and key panelboard alike.

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

.6 Mains: Suitable for bolt-on breakers.

.7 Trim with concealed front bolts and hinges.

.8 Trim and door finish: As per colour schedule.

.2 Breakers:

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

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

.3 Equipment Identification:

.1 Provide equipment identification in accordance with Section 26 05 00 Common Work Results.

.2 Nameplate for each panelboard.

.3 Nameplate for each circuit in distribution panelboards.

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

.4 Accessories:

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

.2 Lock-on devices for fire alarm, emergency, door supervisory, stairway, exit and night light circuits.

.3 Panelboards Switch And Fuse Type:

.1 Panelboards:

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

.1 Assemble panelboard interior before shipment. Ship fuses loose for on-site installation.

.2 In addition to CSA requirements, manufacturer's nameplates must show fault current that panelboard has been built to withstand.

.2 250 and 600 V panelboards: bus and breakers rated for 10 kAIC (symmetrical) interrupting capacity or as indicated.

.3 Panelboards: Mains, number of circuits, and number and size of branch circuit breakers as indicated.

.4 Two keys for each panelboard and key panelboard alike.

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

.6 Mains: Suitable for plug in or bolt-on fusible sections.

.7 Trim with concealed front bolts and hinges.

.8 Trim and door finish: As per colour schedule.

.2 Fuses:

.1 Fuse clips shall be suitable for type of fuses specified for each unit.

.3 Equipment Identification:

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Nameplate for each panel.

.3 Nameplate for each circuit in distribution panels.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit. Install circuit directory under plastic protective cover on front of panel.

.4 Fuses – Low Voltage:

.1 Fuses – General:

.1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.

.2 Type of fuse shall be suitable for specified equipment.

.3 Fuses shall be the product of one manufacturer.

.2 Fuse Types:

.1 Class L Fuses:

.1 Type L1, time delay, capable of carrying 500% of its rated current for 10 seconds minimum.

.2 Type L2, fast acting.

.2 Class J Fuses:

.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 seconds minimum.

.2 Type J2, fast acting.

.3 Class R-R Fuses:

.1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 seconds minimum, to meet UL Class RK1 maximum let-through limits.

.2 Type R2, time delay, capable of carrying 500% of its rated current for 10 seconds minimum.

.3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.

.3 Accessories:

.1 Fuse Storage Cabinet:

.1 Fuse storage cabinet, manufactured with hinged, lockable front access door finished in accordance with Section 26 05 00 – Common Work Results for Electrical.

.5 Moulded Case Circuit Breakers:

.1 Breakers General:

.1 [Moulded-case circuit breakers,] [Circuit breakers,] [and] [Ground-fault circuit-interrupters,] [Fused circuit breakers,] [and] [Accessory high-fault protectors] to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation [with temperature compensation for 40°C ambient].

.3 Common-trip breakers with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from [three to eight] times current rating.

.5 Circuit breakers with interchangeable trips [as indicated].

.6 Circuit breakers to have minimum 10kA symmetrical RMS interrupting capacity rating or as indicated.

.2 Thermal Magnetic Breakers:

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.3 Magnetic Breakers:

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

.4 Current Limiting and Series Rated Thermal Magnetic Breakers:

.1 Thermal magnetic breakers with current limiters:

.1 Time current limiting characteristics of fuses limiters coordinated with time current tripping characteristics of circuit breaker.

.2 Coordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker.

.2 Series rated breakers to be manufacturer tested and listed. Breakers to be applied following manufacturer's guidelines and accepted best practice.

.1 Breakers applied following manufacturer's guidelines and accepted best practice.

.5 Solid State Trip Breakers:

.1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and [long time] [short time] [instantaneous] tripping for [phase] [ground] fault short circuit protection.

.6 Accessories:

.1 Shunt trip.

.2 Auxiliary switch.

.3 Motor-operated mechanism [complete with time delay unit].

.4 Under-voltage release.

.5 On-off locking device.

.6 Handle mechanism.

.6 Disconnect Switches – Fused And Non-Fused:

.1 Disconnect Switches:

.1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure, to CAN/CSA C22.2 No.4 size as indicated.

.2 Provision for padlocking in off switch position by locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuseholders: to [CSA C22.2 No.39] suitable without adaptors, for type and size of fuse indicated.

.5 Quick make, quick break action.

.6 ON OFF switch position indication on switch enclosure cover.

PART 3 - EXECUTION

NOT USED

END OF SECTION

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SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

.1 Provide materials and installation for wiring devices.

.2 Provide specification-grade switches.

.3 Provide switches of one manufacturer throughout project.

.4 Provide receptacles of one manufacturer throughout project.

1.2 RELATED SECTIONS

.1 01 33 00 Submittal Procedures.

.2 01 47 15 Sustainable Requirements.

.3 01 61 00 Common Product Requirements.

.4 01 78 00 Closeout Submittals.

.5 02 81 01 Hazardous Materials.

.6 26 05 00 Common Work Results for Electrical.

1.3 REFERENCES

.1 British Columbia Building Code, 2012 Edition or latest edition (BCBC).

.2 CSA C22.1-15 Canadian electrical code, part I (23rd edition), safety standard for electrical installations, Update No. 1 (2015) or latest edition.

.3 CSA C22.2 No.42-10(R2015) General use receptacles, attachment plugs, and similar wiring devices, Includes Update No. 1 (2013).

.4 CAN/CSA C22.2 No.42.1-13 Cover plates for flush-mounted wiring devices (Bi-National standard, with UL 514D), Update No. 1 (2016).

.5 CSA C22.2 No.55-15 Special Use Switches.

.6 CSA C22.2 No.111-10(R2015) General-use snap switches (Bi-national standard, with UL 20), Includes Update No. 1 (2012).

1.4 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer’s printed product literature, specifications and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 47 15 Sustainable Requirements: Construction and Section 02 81 01 Hazardous Materials and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Shop Drawings:

.1 Submit Shop Drawings in accordance with Section 26 05 00 Common Work Results for Electrical.

.4 Closeout Submittals:

.1 Provide maintenance data for materials for incorporation into manual specified in Section 01 78 00 Closeout Submittals.

.2 Data necessary for maintenance of materials.

.3 Manufacturer's recommended list of spare parts.

1.5 DELIVERY STORAGE AND HANDLING

.1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.3 Handle materials with suitable lifting equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with specifications the following manufacturers are acceptable:

.1 Hubbell.

.2 Or acceptable alternative.

2.2 PRODUCTS

.1 Switches:

.1 15 A, 125 V, 347 V, single pole switches.

.2 Manually operated general purpose AC switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for side wiring.

.5 White toggle.

.3 Toggle-operated, fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Acceptable Manufacturers:

.1 Hubbell 1201.

.2 Or acceptable alternative.

.2 Receptacles:

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

.1 White urea moulded housing.

.2 Suitable for No. 10 AWG for side wiring.

.3 Break off links for use as split receptacles.

.4 Four side wiring screws.

.5 Triple wipe contacts and riveted grounding contacts.

.2 Ground Fault Interrupter type to be 15 A, 125 V or rating as indicated duplex receptacles to be 2-pole, 3-wire specification grade, white face, parallel blade, U ground, impact resistant, nylon face complete with breaker and reset button.

.3 Arc Fault Circuit Interrupter type to be 15 A, 125 V or rating as indicated duplex receptacles to be 2-pole, 3-wire specification grade, white face, parallel blade, U ground, impact resistant, nylon face complete with breaker and reset button.

.4 All other single outlet and special purpose receptacles as indicated are to be similar to the specification grade.

.5 Acceptable Manufacturers:

.1 Hubbell 5252 and Hubbell GFI5 WL and Hubbell USB.

.2 Or acceptable alternative.

.3 Dimmers:

.1 Flush-mounted – specification grade.

.2 Incandescent application: 600 - 1500 watts based on connected load plus 25% spare.

.3 Electronic ballast application: Compatible with ballasts specified.

.4 Radio interference suppression.

.5 Thin profile: Slide to OFF feature.

.6 Finish: White or as indicated.

.7 Acceptable Manufacturers:

.1 Leviton.

.2 Or approved alternative.

.4 Cover Plates:

.1 Cover plates for wiring devices: to CSA C22.2 No.42.1.

.2 Weatherproof double lift spring loaded cast aluminum cover plates: Complete with gaskets for duplex receptacles as indicated.

.3 Weatherproof spring loaded cast aluminum cover plates: Complete with gaskets for single receptacles or switches.

.4 Do not use cover plates meant for flush outlet boxes on surface mounted boxes.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verify conditions of substrate are acceptable for wiring devices installation and are in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 05 00 Common Work Results.

.2 Receptacles:

.1 Prior to installation, confirm ampacity, voltage and pin configuration.

.2 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.3 Mount receptacles at height in accordance with Section 26 05 00 Common Work Results.

.4 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.5 Install GFI type receptacles as indicated.

.3 Cover plates:

.1 Install suitable common cover plates where wiring devices are grouped.

.2 Install sheet steel utility box cover for wiring devices in surface mounted utility boxes.

.3 Mount plastic white cover plates, thickness 2.5 mm for wiring devices in flush mounted outlet box.

.4 Mount cast cover plates for wiring devices in surface mounted FS or FD type conduit boxes.

3.2 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

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SECTION 26 28 16.02
MOULDED CASE CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

.1 Provide moulded-case circuit breakers, circuit breakers, and ground-fault circuit-interrupters, fused circuit breakers, and accessory high-fault protectors.

1.2 RELATED SECTIONS

.1 Refer to Division 26 Electrical.

1.3 REFERENCES

.1 British Columbia Building Code, 2012 Edition or latest eddition (BCBC).

.2 CSA C22.2 No. 5-13 Molded-case circuit breakers, molded-case switches and circuit-breaker enclosures (Tri-national standard, with UL 489 and NMX-J-266-ANCE-2013), Update No. 1 (2014).

1.4 PERFORMANCE REQUIREMENTS

.1 Series rated breakers: Ensure breakers are manufacturer tested and listed.

.1 Apply breakers following manufacturer's guidelines and accepted best practice.

.2 Thermal Magnetic Breakers:

.1 Moulded case circuit breaker to operate automatically.

.2 Thermal and magnetic tripping devices will provide inverse time current tripping and instantaneous tripping for short circuit protection.

.3 Magnetic Breakers:

.1 Moulded case circuit breaker to operate automatically.

.2 Magnetic tripping devices will provide instantaneous tripping for short circuit protection.

.4 Current Limiting and Series Rated Thermal Magnetic Breakers:

.1 Thermal magnetic breakers with current limiters:

.1 Coordinate time current limiting characteristics of fuses limiters with time current tripping characteristics of circuit breaker.

.2 Coordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker.

1.5 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer’s printed product literature, specifications and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 47 15 Sustainable Requirements: Construction and Section 02 81 01 Hazardous Materials and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Include time-current characteristic curves for breakers [with ampacity of [___] A and over] [or] [with interrupting capacity of [22,000] A symmetrical (RMS) and over at system voltage].

.3 Shop Drawings:

.1 Submit Shop Drawings in accordance with Section 26 05 00 Common Work Results for Electrical.

.4 Closeout Submittals:

.1 Provide maintenance data for materials for incorporation into manual specified in Section 01 78 00 Closeout Submittals.

.2 Data necessary for maintenance of materials.

.3 Manufacturers recommended list of spare parts.

1.6 DELIVERY STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with specifications the following manufacturers are acceptable:

.1 Eaton.

.2 Schneider.

.3 Or approved alternative.

2.2 PRODUCTS

.1 Breakers - General:

.1 [Moulded-case circuit breakers,] [Circuit breakers,] [and] [Ground-fault circuit-interrupters,] [Fused circuit breakers,] [and] [Accessory high-fault protectors] to CSA C22.2 No. 5.

.2 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation [with temperature compensation for 40°C ambient].

.3 Plug-in moulded case circuit breakers: quick-make, quick-break type, for manual and automatic operation [with temperature compensation for 40°C ambient].

.4 Common-trip breakers with single handle for multi-pole applications.

.5 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from [three to eight] times current rating.

.6 Circuit breakers with interchangeable trips [as indicated].

.7 Circuit breakers to have minimum [___] symmetrical RMS interrupting capacity rating.

2.3 ACCESSORIES

.1 Shunt trip.

.2 Auxiliary switch.

.3 Motor-operated mechanism [complete with time delay unit].

.4 Under-voltage release.

.5 On-off locking device.

.6 Handle mechanism.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Solid State Trip Breakers:

.1 Operate moulded case circuit breaker by solid-state trip unit with associated current monitors and self-powered shunt trip.

.2 The operation provides:

.1 Inverse time current trip under overload conditions.

.2 [long time] [short time] [instantaneous] tripping for [phase] [ground] fault short circuit protection.

END OF SECTION

This document contains standards that are the minimum requirements for BCIT construction projects. The information in the document is organized using the MasterFormat® and SectionFormat® systems. It is not a specification; it is intended to supplement the Consultant's own documents. Do not use this information as a standalone specification.

SECTION 26 30 00
FACILITY ELECTRICAL POWER GENERATING AND STORING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

.1 Provide facility electrical power generating and storing equipment as specified.

.2 Provide custom fabricated steel enclosure for generator. Lockable, vandal resistant complete with automatic intake and exhaust air dampers.

.3 Provide vertically hinged access doors where required to access equipment for routine operation and maintenance of generator, engine and control panel.

.4 Provide intake and exhaust openings, sized to generator manufacturer's recommendations, complete with automatic motorized damper, silencers, hood and bird screen.

1.2 REFERENCES

.1 API Std. 650 Welded Tanks for Oil Storage, Twelfth Edition, Includes Errata 1 (2013), Errata 2 (2014), and Addendum 1 (2014).

.2 British Columbia Building Code, 2012 Edition or latest edition (BCBC).

.3 CCME PN 1326-2013 Environmental Code of Practice for Aboveground and Underground Storage Tank Systems for Petroleum Products and Allied Petroleum Products.

.4 CSA C22.1-15 Canadian electrical code, part I (23rd edition), safety standard for electrical installations, Update No. 1 (2015) or latest edition.

.5 CSA C22.2 No. 5-13 Molded-case circuit breakers, molded-case switches and circuit-breaker enclosures (Tri-national standard, with UL 489 and NMX-J-266-ANCE-2013), Update No. 1 (2014).

.6 CSA C22.2 No.178.1-14 Transfer Switch Equipment, Includes Update No. 1 (2015).

.7 ISO 3046-1-2002 Reciprocating Internal Combustion Engines Performance Part 1: Declarations of Power, Fuel and Lubricating Oil Consumptions, and Test Methods - Additional requirements for engines for general use.

.8 NEMA MG 1-2014 Motors and Generators.

.9 CSA 282-2005 or latest edition Emergency electrical power supply for buildings

.10 CSA B139-1971 or latest edition, Installation code for oil burning equipment

.11 ULC 601 Standard for Shop Fabricated Steel Aboveground Horizontal Tanks for Flammable and Combustible Liquids (CAN/ULC S601-14).

.12 ULC 603 Standard for Steel Underground Tanks for Flammable and Combustible Liquids (ULC S603-14).

1.3 SYSTEM DESCRIPTION

.1 Power Generation Diesel: Generating system consists of:

.1 Diesel engine.

.2 Alternator.

.3 Alternator control panel.

.4 Automatic transfer equipment.

.5 Battery charger and battery.

.6 Automatic engine room ventilation system.

.7 Fuel supply system.

.8 Exhaust system.

.9 Steel mounting base.

.10 Synchronizing panel.

.11 Manual bypass switch.

.12 System designed to operate as emergency standby.

.2 Automatic Transfer Switch: Automatic load transfer equipment to:

.1 Monitor voltage on phases of normal power supply.

.2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase below pre-set adjustable limits for adjustable period of time.

.3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.

.4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on phases above adjustable pre-set limit for adjustable time period.

.5 Shutdown standby unit after running unloaded to cool down using adjustable time delay relay.

.6 Integrate with Building Management System (BMS).

1.4 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 47 15 Sustainable Requirements: Construction and Section 02 81 01 Hazardous Materials and include: product characteristics, performance criteria, physical size, horsepower, watt rating, limitations and finish.

.3 Shop Drawings:

.1 Submit Shop Drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, and include:

.1 Engine: Make and model, with performance curves.

.2 Alternator: Make and model.

.3 Voltage Regulator: Make, model and type.

.4 Automatic Transfer Switch: Make, model and type.

.5 Manual Bypass Switch: Make and model.

.6 Battery: make, type and capacity.

.7 Battery Charger: Make, type and model.

.8 Alternator Control Panel: Make and type of meters and controls.

.9 Governor type and model.

.10 Automatic engine room ventilation system.

.11 Cooling air requirements in m3/s.

.12 British standard or DIN rating of engine.

.13 Flow diagrams for:

.1 Diesel fuel.

.2 Cooling air.

.14 Dimensioned drawing showing complete generating set mounted on steel base, including vibration isolators, exhaust system, drip trays, and total weight.

.15 Continuous full load output of set at 0.8 PF lagging.

.16 Description of set operation including:

.1 Automatic starting and transfer to load and back to normal power, including time in seconds from start of cranking until unit reaches rated voltage and frequency.

.2 Manual starting.

.3 Automatic shutdown and alarm on:

.1 Overcranking.

.2 Overspeed.

.3 High engine temp.

.4 Low lube oil pressure.

.5 Short circuit.

.6 Alternator over voltage.

.7 Lube oil high temperature.

.8 Over temperature on alternator.

.4 Manual remote emergency stop.

.4 Closeout Submittals:

.1 Provide maintenance data for materials for incorporation into manual specified in Section 01 78 00 Closeout Submittals.

.2 Include instructions for particular unit supplied in Operation and Maintenance Manual. Do not include general description of units manufactured by supplier. Include the following:

.1 Operation and maintenance instructions for engine, alternator, control panel, automatic transfer switch, manual bypass switch, battery charger, battery, fuel system, engine room ventilation system, exhaust system and accessories, to permit effective operation, maintenance and repair.

.2 Technical data:

.1 Illustrated parts lists with parts catalogue numbers.

.2 Schematic diagram of electrical controls.

.3 Flow diagrams for:

.1 Fuel system.

.2 Lubricating oil.

.3 Cooling system.

.4 Certified copy of factory test results.

.5 Maintenance and overhaul instructions and schedules.

.6 Precise details for adjustment and setting of time delay relays or sensing controls which require on site adjustment.

1.5 DELIVERY STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

PART 2 - PRODUCTS

2.1 PRODUCT DESCRIPTION

.1 Diesel Engine:

.1 To ISO 3046 1.

.2 In –line, four cycle, six cylinder, turbo charged, synchronous speed 1,800 rpm.

.3 Water cooled diesel engine, pusher fan and radiator

.4 Capacity:

.1 Rated continuous power in __kW at rated speed, after adjustment for system losses in auxiliary equipment necessary for engine operation; to be calculated as follows: Rated continuous output = Generator kW divided by Generator efficiency at full load.

.1 Under following site conditions:

.1 Altitude: 300 m.

.2 Ambient temperature: 0°C.

.3 Relative humidity: 80 %.

.5 Cooling System:

.1 Liquid cooled: Heavy duty industrial radiator mounted on generating set base with engine driven pusher type fan to direct air through radiator from engine side with ethylene glycol anti-freeze non-sludging above -46°C.

.2 To maintain manufacturer's recommended engine temperature range at 10% continuous overload in ambient temperature of 40°C.

.3 Block heater: Thermostatically controlled lube oil or liquid coolant heater connected to line side of automatic transfer switch to allow engine to start in room ambient 0°C.

.1 Switch and fuse in heater circuit, mounted in engine-alternator control cubicle and fed from line side of automatic transfer switch.

.4 Fuel: to CAN/CGSB 3.6, Type A, Arctic Grade 1.

.5 Fuel system: Solid injection, mechanical fuel transfer pump, fuel filters and air cleaner, fuel rack solenoid energized when engine running.

.6 Governor: Mechanical hydraulic with:

.1 Steady state speed band of +/- 0.5%.

.2 Speed regulation no load to full load 5% maximum.

.3 Electronic load sharing type, electric actuator, speed droop externally adjustable from isochronous to 5%, temperature compensated with steady state speed maintenance capability of +/- 0.25%.

.7 Lubrication system:

.1 Pressure lubricated by engine driven pump.

.2 Lube oil filter: Replaceable, full flow type, removable without disconnecting piping.

.3 Lube oil cooler.

.4 Engine sump drain valve.

.5 Oil level dipstick.

.8 Starting system:

.1 Positive shift, gear engaging starter 12 or 24 V DC.

.2 Cranking limiter to provide three cranking periods of 10 seconds duration, each separated by 5 seconds rest.

.3 Lead acid, 12 or 24 V storage battery with sufficient capacity to crank engine for 1 min at 0°C without using more than 25% of ampere hour capacity.

.4 Battery charger: constant voltage, solid state, two-stage from trickle charge at standby to boost charge after use.

.1 Regulation: +/- 1% output for +/- 10% input variation.

.2 Equipped with DC voltmeter, DC ammeter and on/off switch.

.3 Minimum charger capacity: 7 A.

.9 Vibration isolated engine instrument panel complete with:

.1 Lube oil pressure gauge.

.2 Lube oil temperature gauge.

.3 Lube oil level gauge.

.4 Coolant temperature gauge.

.5 Coolant level gauge.

.6 Running time meter: Non-tamper type.

.10 Guards: to protect personnel from hot and moving parts.

.11 Drip tray.

.2 Alternator:

.1 Alternator: to NEMA MG1.

.2 Alternator: Capable of sustaining 300% rated current for period not less than 10 seconds permitting selective tripping of down line protective devices when short circuit occurs.

.3 Rating: 120/208, 347/600 V 3 phase, 4 wire, [___] kW, 60 Hz, at 0.8 PF.

.4 Output at 40°C ambient:

.1 100% full load continuously.

.2 110% full load for 1 hour.

.3 150% full load for 1 minute.

.5 Revolving field, brushless, single bearing.

.6 Drip proof.

.7 Amortisseur windings.

.8 Synchronous type.

.9 Exciter: Permanent magnet.

.10 NEMA Class H insulation on windings.

.11 Thermistors embedded in stator winding and connected to alternator control circuitry.

.12 Voltage Regulator: Thyristor controlled rectifiers with phase controlled sensing circuit:

.1 Stability: +/- 0.25 % maximum voltage variation at any constant load from no load to full load.

.2 Regulation: 1.5 % maximum voltage deviation between no-load steady state and full-load steady state.

.3 Transient: 10 % maximum voltage dip on one-step application of 0.8 PF full load.

.4 Transient: 12 % maximum voltage rise on one-step removal of 0.8 PF full load.

.5 Transient: 2.5 seconds maximum voltage recovery time with application or removal of 0.8 PF full load.

.3 Control Panel:

.1 Totally enclosed, mounting base isolated from diesel generator.

.2 Instruments:

.1 Digital indicating type 2 % accuracy, rectangular face, flush panel mounting:

.1 Voltmeter: AC, scale 0 to 250, 600 V.

.2 Ammeter: AC, scale 0 to [___] A.

.3 Wattmeter scale 0 to [___] kW.

.4 Frequency meter: Scale 55 to 65 Hz.

.5 [kVAR meter] [kW.h meter].

.2 Voltmeter selector switch, rotary, panel mounting, four position, labelled "Off Phase A Phase B Phase C".

.3 Ammeter selector switch, rotary, maintained contacts, panel mounting, designed to prevent opening of current circuits, four position labelled "OFF Phase A Phase B Phase C".

.4 Instrument Transformers:

.1 Potential dry type for indoor use:

.1 Ratio: ___ to 120.

.2 Rating: 250, 600 V, 60 Hz, BIL ___ kV.

.2 Current dry type for indoor use:

.1 Ratio: ___ to 5.

.2 Rating: 250, 600 V, 60 Hz, BIL ___ kV.

.3 Positive action automatic short circuiting device in secondary terminals.

.4 Controls:

.1 Engine start button.

.2 Selector switch: Off Auto Manual.

.3 Engine emergency stop button and provision for remote emergency stop button.

.1 Alternator output breaker:

.1 Circuit Breaker: Bolt-on, moulded case, temperature compensated for 40°C ambient, dual thermal-magnetic trip.

.2 Voltage control rheostat: Mounted on inside of control panel.

.3 Operating lights, panel mounted:

.1 "Normal power" pilot light.

.2 "Emergency power" pilot light.

.3 Green pilot lights for breaker on and red pilot lights for breaker off.

.4 Solid state indicator lights for alarm with two set manually reset NO/NC contacts wired to terminal block for remote annunciation on:

.1 Low fuel level.

.2 Low battery voltage.

.3 Ventilation failure.

.4 Low coolant temperature.

.5 Solid state controller for automatic shutdown and alarms with two set manually reset NO/NC contacts wired to terminal block for remote annunciation on:

.1 Engine overcrank.

.2 Engine overspeed.

.3 Engine high temperature.

.4 Engine low lube oil pressure.

.5 Short circuit.

.6 AC over voltage.

.7 Lamp test button.

.8 Provision for remote monitoring.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 Common Work Results for Electrical and Section 26 05 53 Identification for Electrical Systems (Labeling)

.2 Control panel:

.1 Nameplates for controls including alternator breakers and program selector switch.

.2 Nameplates for meters, alarms, indicating lights and minor controls.

2.3 ACCESSORIES

.1 Steel Mounting Base:

.1 Complete generating set mounted on structural steel base of sufficient strength and rigidity to protect assembly from stress or strain during transportation, installation and under operating conditions on suitable level surface.

.2 Assembly fitted with vibration isolators and control console resiliently mounted.

.3 Spring type isolators with adjustable side snubbers and adjustable for levelling.

.4 Sound insulation pads for installation between isolators and concrete base.

.2 Exhaust System:

.1 Heavy duty residential type horizontally mounted exhaust silencer with condensate drain, plug and flanged couplings.

.2 Heavy duty flexible exhaust pipe with flanged couplings as required.

.3 Fittings and accessories as required.

.4 Expansion joints: stainless steel, corrugated, of suitable length, to absorb both vertical and horizontal expansion.

.3 Fuel System:

.1 Fuel storage tanks: to API Standard 650, ULC labelled.

.2 Sub-base storage tank: __ L, mounted beneath generator.

.3 Fuel level gauge and vent alarm.

.4 Drain and end plug.

.5 Black iron feed and return lines, with flexible terminations at engine.

.6 Shutoff cock.

.7 Renewable cartridge filter.

.8 Fire valve.

.9 Isolating valves on lines serving auxiliaries.

.10 Low fuel level alarm for remote indication.

.4 Cooling Air System:

.1 Engine ventilating system:

.1 Re-circulating damper assembly with modulating motor.

.2 Cold air inlet damper assembly with modulating motor.

.3 Air discharge and intake gooseneck weather hoods.

.4 Modulating thermostat.

.5 Replaceable air intake filters.

.5 Outdoor Enclosure:

.1 Sound attenuation of the enclosure shall not exceed 80dB at 7 meters.

.2 Exterior walls to be minimum 14 gauge steel with R12 rigid insulation. Interior cladding to be minimum 22 gauge steel.

.3 Size the enclosure to provide operating space around all equipment and clearance in front of all electrical equipment. Where applicable, provide adequate space for the automatic transfer switch. Enclosure shall fully enclose sub-base fuel tank.

.4 Mount enclosure on steel base-frame designed to withstand lifting (with generator and all associated equipment), transport and placement.

.5 Enclosure shall be fully weatherproof and constructed to withstand site conditions, including snow loading, in Burnaby, BC.

.6 Complete with two duplex convenience receptacles, LED lighting and connections to block heaters and battery charger.

.7 Where required, provide electric heater in enclosure.

.8 Where required by manufacturer, provide bypass duct option to warm the interior of the generator enclosure to safely operate the generator continually for 72 hours and -___ degree C outside air temperature.

2.4 FABRICATION

.1 Shop assemble generating unit including:

.1 Base.

.2 Engine and radiator.

.3 Alternator.

.4 Control panel.

.5 Battery and charger.

.6 Sub-base fuel tank

.7 Outdoor Enclosure.

2.5 FINISHES

.1 Apply finishes in accordance with Section 26 05 00 Common Work Results for Electrical.

.2 Alternator control cubicle: Paint inside, exterior to match engine and alternator.

.3 Exhaust and inlet air hoods: International orange.

.4 Other ducts and racks: Grey.

.5 Supply 0.25 L of grey touch up enamel.

2.6 SOURCE QUALITY CONTROL

.1 Factory test generator set including engine, alternator, control panels, transfer switch and accessories in presence of Engineer.

.2 Test procedure:

.1 Prepare blank forms and check sheet with spaces to record data and at top of first sheet record:

.1 Date.

.2 Generator set serial no.

.3 Engine, make, model, serial no.

.4 Alternator, make, model, serial no.

.5 Voltage regulator, make and model.

.6 Rating of generator set, kW, kV.A, V, A, r/min, Hz.

.2 Mark check sheet and record data on forms in duplicate as test proceeds.

.3 Engineer signature on completed forms to indicate concurrence in results of test.

.3 Tests:

.1 With 100% rated load, operate set for 8 hours. Take readings at 30 minutes intervals, and record following:

.1 Time of reading.

.2 Running time.

.3 Ambient temp in °C.

.4 Lube oil pressure in kPa.

.5 Lube oil temp in °C.

.6 Engine coolant temp in °C.

.7 Exhaust stack temp in °C.

.8 Alternator Voltage: Phase 1, 2, 3.

.9 Alternator Current: Phase 1, 2, 3.

.10 Power in kW.

.11 Frequency in Hz.

.12 Power Factor.

.13 Battery charger current in A.

.14 Battery voltage.

.15 Alternator cooling air outlet temp.

.2 After completion of 8 hours run, demonstrate following shutdown devices and alarms:

.1 Overcranking.

.2 Overspeed.

.3 High engine temp.

.4 Low lube oil pressure.

.5 Short circuit.

.6 Alternator over voltage.

.7 Low battery voltage, or no battery charge.

.8 Manual remote emergency stop.

.9 High alternator temperature.

.3 Install continuous strip chart recorders to record frequency and voltage variations during load switching procedures. Delay each load change until steady state conditions exist. Switching increments to include:

.1 No load to full load to no load.

.2 No load to 70% load to no load.

.3 No load to 20% load to no load.

.4 20% load to 40% load to no load.

.5 40% load to 60% load to no load.

.6 60% load to 80% load to no load.

.4 Demonstrate:

.1 Automatic starting of set and automatic transfer of load on failure of normal power.

.2 Operation of manual bypass switch.

.3 Automatic shutdown of engine on resumption of normal power.

.4 That battery charger reverts to high rate charge after cranking.

.5 Demonstrate low oil pressure and high engine temperature shutdown devices operation without subjecting engine to these excesses.

.4 Automatic transfer switch:

.1 Instrument transformers: to CAN/CSA C60044-1.

.2 Contactors: to NEMA ICS2.

.3 Contactor Type Transfer Equipment:

.1 Contact Type Transfer Equipment: to CSA C22.2 No.178.1.

.2 Two-three four pole contactors mounted on common frame, in double throw arrangement, mechanically and electrically interlocked, open type with CSA enclosure.

.3 Rated: [___] V, 6 0Hz, [___] A. [two] [three] [four] wire, [solid neutral].

.4 Main Contacts: Silver surfaced, protected by arc disruption means.

.5 Switch and relay contacts, coils, spring and control elements: Ensure accessibility for inspection and maintenance from front of panel without removal of switch panel or disconnection of drive linkages and power conductors.

.6 Auxiliary Contact: Silver plated, to initiate emergency generator start-up on failure of normal power.

.7 Fault withstand rating: [___] kA symmetrical for three cycles with maximum peak value of [___] kA.

.8 Lever: to operate switch manually when switch is isolated.

.9 Neutral bar, solid rated: [___] A.

.5 Automatic Transfer Switch Controls:

.1 Selector switch four position "Test", "Auto", "Manual", "Engine start".

.1 Test position: Normal power failure simulated. Engine starts and transfer takes place. Return switch to "Auto" to stop engine.

.2 Auto position: Normal operation of transfer switch on failure of normal power. Retransfers on return of normal voltage and shuts down engine.

.3 Manual position: Transfer switch may be operated by manual handle. Note that transfer switch will not operate automatically and engine will not start.

.4 Engine start position: Engine starts but unit will not transfer unless normal power supply fails. Switch must be returned to "Auto" to stop engine.

.6 Control transformers: Dry type with 120 V secondary to isolate control circuits from:

.1 Normal power supply.

.2 Emergency power supply.

.3 Relays: Continuous duty, industrial control type, with wiping action contacts rated 10 A minimum:

.1 Voltage sensing: Three-phase for normal power and on one phase only for emergency. Type: Solid state, adjustable drop out and pick up, close differential, 2 V minimum under voltage and over voltage protection.

.2 Time delay: Normal power to standby, adjustable 5 to 180 seconds.

.3 Time delay on engine starting: To override momentary power outages or dips, adjustable, 0 to 60 seconds delay.

.4 Time delay on retransfer from standby to normal power: Adjustable 20 seconds to 10 minutes.

.5 Time delay for engine cool-off: To permit standby set to run unloaded after retransfer to normal power, adjustable 20 second intervals to 10 minutes.

.6 Time delay during transfer: To stop transfer action in neutral position to prevent fast transfer, adjustable, 5 second intervals to 180 seconds.

.7 Frequency sensing: To prevent transfer from normal power supply until frequency of standby unit reaches preset adjustable values.

.8 Neutral position delay: Allow time for motors to delay between live sources, adjustable, 0 to 5 s.

.7 Automatic Transfer Switch - Accessories:

.1 Ensure pilot lights indicate power availability.

.2 Switch positions: Mounted in panel.

.1 Normal: Green.

.2 Standby: Red.

.3 Auxiliary relay: to provide 2 N.O. and 2 N.C. contacts for remote alarms.

.4 Manual bypass and isolator: to both supplies.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Locate guards so that normal daily maintenance inspections can be undertaken without their removal.

.2 Locate generating unit and install as indicated.

.3 Locate, install and connect transfer equipment as indicated.

.4 Install fuel supply system as indicated in CSA B139.

.5 Install and connect battery and remote alarms.

.6 Complete wiring and interconnections as indicated.

.7 Complete generator running and failure monitoring signals to fire alarm panel and FA verification afterwards

.8 Start generating set and test to ensure correct performance of components.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 Common Work Results for Electrical.

.2 Provide fuel for testing and leave full tanks on acceptance.

.3 Demonstrate – Generator:

.1 Automatic control: Unit start, transfer to load, retransfer to normal power, unit shutdown.

.2 Manual control: Unit start and shutdown.

.3 Test control: Unit start and transfer.

.4 Engine Start control: Unit start.

.5 Operation of manual bypass switch.

.6 Operation of automatic alarms and shutdown devices.

.4 Demonstrate - Transfer Switch:

.1 Energize transfer equipment from normal power supply.

.2 Set selector switch in "Test" position: To ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.

.3 Set selector switch in "Manual" position: Check to ensure proper performance.

.4 Set selector switch in "Engine start" position: Check to ensure proper performance.

.5 Return switch to "Auto" to stop engine.

.6 Set selector switch in "Auto" position: Open normal power supply disconnect.

.1 Standby should start, come up to rated voltage and frequency. Load then transfers to standby.

.2 Allow to operate for [10] minutes, then close main power supply disconnect. Load then transfers back to normal power supply and standby should shutdown.

.3 Repeat at 1 hour intervals, [___] times.

.4 Complete test with selector switch in each position, for each test.

.5 Run unit on load for minimum of 4 hours to show load carrying ability, stability of voltage and frequency, and satisfactory performance of dampers in ventilating system to provide adequate engine cooling.

.6 At end of test run, check battery voltage to demonstrate battery charger has returned battery to fully charged state.

.7 Submittal – A testing and commissioning report shall be stamped and signed by a professional engineer registered, or licensed in Province of British Columbia.

.8 Submittal – A fire alarm verification report for the generator signals shall be submitted by an ULC test agency.

3.3 CLEANING

.1 Clean in accordance with Section 01 74 11 Cleaning.

.2 Remove surplus materials, excess materials, rubbish, tools and equipment.

3.4 PROTECTION / MAINTENANCE

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and CSA B139.

END OF SECTION

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SECTION 26 51 00
LIGHTING INTERIOR

PART 1 - GENERAL

1.1 SUMMARY

.1 Materials and Installation for lighting.

.2 Lighting Levels.

.3 Energy Efficiency.

.4 Lighting Standard applies to the following BCIT facilities:

- .1 New buildings.
- .2 New portions of buildings.
- .3 Renovations to existing buildings.

.5 Select LED lighting for the following:

- .1 Classrooms.
- .2 Laboratory.
- .3 Computer Lab.
- .4 Offices – Open.
- .5 Offices – Private.
- .6 Washroom.
- .7 Corridor.

.6 Provide night lighting in spaces to allow safe passage for those entering the space at night.

1.2 REFERENCES

.1 ANSI C78.377-2015 American National Standard for Electric Lamps - Specifications for the Chromaticity of Solid State Lighting (SSL) Products.

.2 ANSI C82.1-98 Electric Lamp Ballast - Line Frequency Fluorescent Lamp Ballast.

.3 ANSI C82.4-2002 Ballasts for high - intensity - discharge and low pressure sodium lamps (multiple-supply type).

.4 ASHRAE 90.1-2013 Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI Approved; IES Co-sponsored).

.5 British Columbia Building Code, 2012 Edition or latest edition (BCBC).

.6 CSA C22.1-15 Canadian electrical code, part I (23rd edition), safety standard for electrical installations, Update No. 1 (2015) or latest edition.

.7 ICES-005-07 Radio Frequency Lighting Devices, Issue 2.

.8 IES LM-79-08 SSL Electrical and Photometric Measurements of Solid-State Lighting Products.

.9 IES LM-80-15 Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules.

.10 IES RP-16-2010 Nomenclature and Definitions for Illuminating Engineering.

.11 UL 8750-15 Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.3 REQUIREMENTS

.1 Fixture Selection: Efficiency of the light source and luminaire is a significant factor.

.2 LED is the preferred light source.

.3 Select luminaires to achieve BCIT's objectives of quality lighting with minimum energy consumption.

.4 Do not use metal halide, high pressure sodium, or incandescent lighting.

.5 Lighting Standards for building interiors vary depending on the usage. Lighting levels, energy efficiency, and controls shall be as outlined in Table 1 - BCIT Lighting Standards - Interior.

.6 Luminaire selection for interiors shall be based on area usage, ceiling type, lighting levels, and other contributing factors. Selection of a BCIT standard fixture with standard components is recommended. Refer to Appendix 'A' - Selection of Luminaires – Interior.

1.4 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide complete photometric data prepared by independent testing laboratory for luminaires when requested.

1.5 QUALITY ASSURANCE

.1 Provide the following in accordance with Section 01 45 00 Quality Control.

.2 Mock-Ups: Provide mock-ups in accordance with Section 01 45 00 Quality Control.

.3 Manufacturer's instructions: Provide manufacturer's written installation instructions and special handling criteria, installation sequence, and cleaning procedures.

.4 Closeout Submittals:

.1 Provide maintenance data for materials for incorporation into manual as specified in Section 01 78 00 Closeout Submittals.

.2 Data necessary for maintenance of materials.

.3 Manufacturers recommended list of spare parts.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: Remove for reuse in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

.4 Divert unused metal materials from landfill to metal recycling facility.

.5 Dispose and recycle fluorescent lamps as per local regulations.

.6 Dispose of old PCB filled ballasts.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with specifications the following manufacturers are acceptable:

.1 Refer to Section 26.51.01 Appendix A Luminaires Interior.

2.2 PRODUCTS

.1 Light Source: Fluorescent 4 foot linear lamps, T8, T5, T5HO, or compact fluorescent are acceptable where approved by BCIT.

.2 Colour Temperature: All light sources are to be 4000°K - 4100°K.

.3 Voltage:

.1 Lighting fixture voltage shall be consistent throughout each building. Refer to the following:

Building Distribution	Lighting Voltage
120/208 Volts	120 Volts
120/240 Volts	120 Volts
277/480 Volts	277 Volts
347/600 Volts	347 Volts

.4 Ballasts: Where used, ballasts for fluorescent fixtures shall be electronic, high frequency, program start. Dimmable as indicated.

.5 LED Drivers:

.1 Supply LED drivers with 0-10 volt dimming as a standard.

.2 Housing protection against moisture, dust, and vibrations.

.3 Minimum 50,000 hours life.

.4 Module temperature control.

.5 Constant light output.

.6 Compliance with IES LM-80 Standards.

.6 Diffusers:

.1 Luminaires with diffusers shall have durable, long life diffusers to minimize glare and maximize lighting uniformity.

.2 Design diffusers for LED luminaires for LED fixture applications.

.3 Diffusers for fluorescent luminaires shall be prismatic, acrylic, minimum 0.125” thickness.

.7 Lamps:

.1 LED Light Source:

.1 Source high efficiency LED with the following features:

.1 Nominal 100 lumens/watt or better; minimum 75 lm / watt.

.2 Rated life: Minimum L70 at 50,000 hours.

.3 4100°K colour temperature.

.4 Compliance with IES LM-79 Standards.

.2 Fluorescent - T8:

.1 Except where ambient temperature is below 20°C, T8 fluorescent lamps shall be:

.1 48", 28 watt, T8, Bi-Pin Base.

.2 4100°K colour temperature.

.3 82-86 colour rendering index (CRI).

.4 Long Life 80,000 hours (at 3 hour start) preferred.

.5 Ultra low mercury type.

.2 The use of 2' or 3' fluorescent lamps acceptable where approved by BCIT.

.3 For areas below 20°C, use 48" 32 watt T8 lamps with matching specifications.

.3 Fluorescent - T5 and T5HO:

.1 Use fluorescent T5 and T5HO lamps only where not exposed to cool temperatures or air movement across the lamp.

.2 T5 and T5HO fluorescent lamps:

.1 46" 25 watt T5, Bi-Pin Base, or 46" 44 watt T5HO, Bi-Pin Base.

.2 4100°K colour temperature.

.3 82-85 colour rendering index (CRI).

.4 Rated life 25,000 hours (3 hour start).

.5 Ultra low mercury type.

.4 Compact Fluorescent: The following are acceptable where approved for use by BCIT:

.1 26, 32, or 42 watt.

.2 Triple tube, 4 pin.

.3 4100°K colour temperature.

.4 82-85 colour rendering index (CRI).

.5 Minimum Rated Life 16,000 hours.

.6 Low mercury type.

.8 Luminaire Selection:

.1 Preferred luminaires: 2' x 4' luminaires or as indicated.

.2 Instructional Shops: High Bay LED luminaires are preferred.

2.3 INTERIOR LIGHTING STANDARDS

.1 Lighting calculations must be made for maintained footcandle (lux) levels.

.2 BCIT Lighting Standards – Interior: Refer to tables on next page.

BCIT Lighting Standards - Interior									
		ILLUMINATION			LIGHTING CONTROL				
	AREA USE	FC	LUX	LPD[1]	LOCAL SWITCH	VACANCY SENSOR	MULTI-LEVEL SWITCH	OCCUPANCY SENSOR	BCIT MASTER CONTROLS
1	Classroom	50-60	500-600	1.24	X	X	X		X
2	Lecture Hall	40-50	400-500	1.24	X	X	X		X
3	Laboratory	50-60	500-600	1.28	X		X		X
4	Computer Lab	35-45	350-450	1.28	X		X		X
5	Instructional Shop	40-50	400-500	1.59	X				X
6	Offices - Open Area	50	500	0.98	X		X		
7	Offices - Private	50	500	1.11	X	X	X		
8	Meeting Room	40-50	400-500	1.23	X	X	X		
9	Staff Room	30-40	300-400	0.73	X	X	X		
10	Washroom	20	200	0.98		X		X	X
11	Corridor	20	200	0.66				X	X
12	Stairwell	20	200	0.69					X
13	Change or Locker Room	30	300	0.75	X	X			X
14	Storage Room	30	300	0.63	X	X			
15	Service Room	30	300	0.95	X	X [2]			

[1] Lighting Power Density - Based on IES/ASHRAE 90.1-2010 or latest version

[2] Vacancy sensor to be provided in Service Rooms if less than 250 ft^2

LUMINAIRE	APPLICATION (AREA USE #)
2 x 2 Recessed LED	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13
2 x 4 Recessed LED	1, 2, 3, 4, 6, 10, 13
1 x 4 Recessed LED	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 13
Recessed LED Pot Light	8, 9, 10
Suspended LED Direct/Indirect	Rooms without suspended ceilings
Surface LED Wrap	10, 12, 13, 14, 15
High Bay LED	5
Wall Mounted LED	10, 12, 14
Suspended Industrial Fluorescent	14, 15

Refer to Appendix A - Luminaires Interior

PART 3 - EXECUTION

3.1 LIGHTING INSTALLATION

.1 Include a minimum of one (1) night light in the following areas:

- .1 Open offices.
- .2 Instructional shops.
- .3 Large rooms or areas over 1500 ft^2.

.2 Provide night lights every 50 ft. in corridors and hallways.

.3 Measure the illumination level after completion and submit a commissioning report

.4 Provide seismic certificate for suspended light fixtures after installation

END OF SECTION

APPENDIX 'A'

Selection of Luminaires - Interior

FIXTURE PART NUMBERS MAY NOT BE THE MOST CURRENT FROM THE MANUFACTURERS. REVIEW WITH MANUFACTURER'S REPRESENTATIVE IS RECOMMENDED

PART 1 - GENERAL

1.1 SUMMARY

.1 Interior luminaires shall be manufactured by:

- .1 Cooper Lighting
- .2 General Electric
- .3 Philips

.2 Luminaire components, voltages, and features shall be as outlined in these Standards.

.3 LED luminaires are preferred and shall be selected wherever practical.

PART 2 - LUMINAIRES

2.1 2 X 2 RECESSED LED

.1 Metalux 'Encounter' #22EN-LDI-34-UNV-L840-

.2 Metalux 'Accord' #22AC-LD3-34-UNV-L840-CD1

.3 General Electric Lumination 'ET 22' Series #ET 22-0A3-A-VW

.4 Philips 'Arioso' #2AVE-G38L-840-2ACR-UNV-DIM

2.2 2 X 4 RECESSED LED

.1 Metalux 'Encounter' #24EN-LDI-67-UNV-L480-CD1

.2 Metalux 'Accord' #24AC-LD3-55-UNV-L840-CD1

.3 Philips 'Arioso' #2AVE-G74L-840-4ACR-UNV-DIM

2.3 1 X 4 RECESSED LED

.1 Metalux 'Encounter' #14EN-LDI-38-UNV-L840-CD1;

.2 Metalux 'Encounter' #14EN-LDI-51-UNV-L840-CD1

.3 Metalux 'Accord' #14 AC-LD3-39-UNV-L840-CD1

.4 General Electric Lumination 'ET 14' Series #ET14-0A3-AVW

.5 Philips 'Arioso' #1AVE-G38L-840-4ACR-UNV-DIM

2.4 4" RECESSED LED POTLIGHT

.1 Halo 'H4' #H455 T UNV D010 – Housing

Halo 'H4' #EL405 840 - LED Light

Halo 'H4' #TL410 H – Trim

.2 Lightolier 'Calculite' #CRL-10NU-VB-Z10V - Frame in kit

Lightolier 'Calculite' #C4L-10 (or 05) DL 40K-CCD-WVB – Trim

2.5 5" RECESSED LED POTLIGHT

.1 Halo

.2 Lightolier

2.6 6" RECESSED LED POTLIGHT

.1 Halo

.2 Lightolier 'Calculite' #C6L-Lumens-NU-VB-Z10V - Frame in kit

Lightolier 'Calculite' #C6L-Lumens-DL40K-MCCD-WVB – Trim

2.7 SUSPENDED LED DIRECT/INDIRECT

.1 Corelite 'Divide' #DRI-WS-XL40-1D-UNV-14

.2 Ledalite 'Sync LED' #7406-LAC-QN04-1120-W

.3 Ledalite 'FloatPlane' #24-G5-L-A-C-A-G-__-1-_-_-W

.4 General Electric 'Lumination' #

2.8 SURFACE LED WRAP

.1 Metalux 'WNLED' #4WNLED-LD1-27F-UNV-L840-CD1

.2 Philips 'Flux Stream' #LF4FR-3140U-DZT

2.9 HIGH BAY T5HO

.1 Metalux 'HBLED' #HBLED-LD324-X-LENS-UNV-CD1

2.10 WALL MOUNTED LED

.1 Finelite 'HP4' #HP-4WM-D (or D/I) -450-4000-UNV

.2 Corelite 'Divide' #

2.11 SUSPENDED INDUSTRIAL FLUORESCENT - T5HO

.1 Metalux 'DIF' #DIF-254T5-UNV-EBT

.2 CFI #FF 248-UNV - Electronic PRS Ballast

2.12 SURFACE LED - 8" X 8"

.1 Philips 'eW Downlight' #

PART 3 - DRIVERS AND BALLASTS

3.1 LED DRIVERS

.1 Shall be manufactured by:

.1 General Electric

.2 Philips Advance

3.2 FLUORESCENT BALLASTS

.1 Shall be manufactured by:

.1 General Electric

.2 Philips Advance; Optanium Series

PART 4 - LAMPS

4.1 LED

.1 Light sources shall be manufactured by:

.1 Cree

.2 Nichia

.3 Philips

.4 Samsung

4.2 FLUORESCENT

.1 Lamps shall be manufactured by:

.1 General Electric

.2 Philips

APPENDIX 'B'

Selection of Luminaires – Emergency Lighting

FIXTURE PART NUMBERS MAY NOT BE THE MOST CURRENT FROM THE MANUFACTURERS. REVIEW WITH MANUFACTURER'S REPRESENTATIVE IS RECOMMENDED

PART 1 - GENERAL

1.1 SUMMARY

.1 Battery Units

.1 Battery units shall be 360 watts, 12 Volt DC output.

.2 Emergency lighting battery units shall be manufactured by:

.1 Beghelli 'Nova' Series #NV12-360/0

.2 Ready-Lite 'LDX' Series #LDX12-360

.2 Remote Heads

.1 Remote heads shall be manufactured by:

.1 Beghelli 'SR PAR 18' Series

.1 Single Head: #SR1-LEDMR16/7W/12V

.2 Double Head: #SR2-LEDMR16/7W/12V

.2 Ready-Lite 'RM' Series

.1 Single Head: #RM1-LD7

.2 Double Head #RM2-LD7

APPENDIX 'C'

Selection of Luminaires – Exit Sign

FIXTURE PART NUMBERS MAY NOT BE THE MOST CURRENT FROM THE MANUFACTURERS. REVIEW WITH MANUFACTURER'S REPRESENTATIVE IS RECOMMENDED

PART 1 - GENERAL

1.1 SUMMARY

.1 Exit lights shall be green pictogram style (white pictogram, green background) manufactured by:

.1 Beghelli 'Verde RM' Series #VE-RM-LU-OLR-M (ac only)

.2 Beghelli 'Verde RM Series #VE-RM-LU-OLR-M-UDC (with 12V dc)

.3 Ready-Lite 'RP' Series # RP – (1, 2, or 3) - WU

This document contains standards that are the minimum requirements for BCIT construction projects. The information in the document is organized using the MasterFormat® and SectionFormat® systems. It is not a specification; it is intended to supplement the Consultant's own documents. Do not use this information as a standalone specification.

SECTION 26 56 00
LIGHTING EXTERIOR

PART 1 - GENERAL

1.1 SUMMARY

.1 Materials and installation for lighting.

.2 Lighting levels.

.3 Energy efficiency.

.4 Lighting standard applies to the following BCIT facilities:

.1 Pathways.

.2 Sidewalks.

.3 Parking Lots.

.4 Roadways.

1.2 REFERENCES

.1 ANSI C78.377-2015 American National Standard for Electric Lamps - Specifications for the Chromaticity of Solid State Lighting (SSL) Products.

.2 ASHRAE 90.1-2013 Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI Approved; IES Co-sponsored).

.3 British Columbia Building Code, 2012 Edition or latest edition (BCBC).

.4 CSA C22.1-15 Canadian electrical code, part I (23rd edition), safety standard for electrical installations, Update No. 1 (2015) or latest edition.

.5 ICES-005-07 Radio Frequency Lighting Devices, Issue 2.

.6 IES LM-79-08 SSL Electrical and Photometric Measurements of Solid-State Lighting Products.

.7 IES LM-80-15 Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules.

.8 IES RP-16 Solid State Lighting Standards and Definitions

.9 UL 8750-15 Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products.

1.3 REQUIREMENTS

.1 Fixture Selection: Efficiency of the light source and luminaire is a significant factor. LED is the preferred light source. Full vision cutoff shall be provided.

.2 Do not use metal halide, high pressure sodium, and incandescent lighting.

.3 Lighting Standards for EXTERIOR APPLICATIONS vary depending on the usage. Lighting levels, energy efficiency, and controls shall be as outlined in Table 1 - BCIT Lighting Standards - Exterior.

.4 Selection of a BCIT standard fixture with standard components is recommended. Refer to Appendix ‘D’ - Selection of Luminaires – Exterior.

1.4 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide complete photometric data prepared by independent testing laboratory for luminaires when requested.

.3 Mock-Ups: Provide mock-ups in accordance with Division 01.

.4 Manufacturer's Instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, and cleaning procedures.

.5 Closeout Submittals:

.1 Provide maintenance data for materials for incorporation into manual specified in Section 01 78 00 Closeout Submittals.

.2 Data necessary for maintenance of materials.

.3 Manufacturers recommended list of spare parts.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Packaging Waste Management: Remove for reuse in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.

.4 Divert unused metal materials from landfill to metal recycling facility.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Subject to compliance with specifications the following manufacturers are acceptable:

.1 Refer to Section 26 56 01 Appendix D Selection of Luminaires - Exterior.

2.2 PRODUCT DESCRIPTION

.1 Light Source:

.1 Colour Temperature:

.2 All light sources: 4000°K - 4100°K

.2 Poles:

.1 Finish: Galvanized with painted finish.

.2 Complete with standard base plate.

.3 Shape: Square.

.4 Colour: Black.

.3 LED Drivers:

.1 Standard: Supply LED drivers with 0-10 volt dimming.

.2 Protection: Protect housing against moisture, dust, and vibrations.

.3 Minimum: 50,000 hours life.

.4 Temperature Control: Module.

.5 Light Output: Constant.

.6 Compliance with IES LM-80 Standards.

.4 Diffusers:

.1 Luminaires with diffusers shall have durable, long life diffusers to minimize glare and maximize lighting uniformity.

.2 Design diffusers for LED luminaires for LED fixture applications.

.5 Lamps: LED Light Source:

.1 Source high efficiency LED with the following features:

.1 Nominal: 100 lumens/watt or better.

.2 Minimum: 75 lm / watt.

.3 Rated life: Minimum L70 @ 50,000 hours.

.4 Colour temperature: 4100°K.

.5 Compliance with IES LM-79 Standards.

.6 Luminaires:

.1 All exterior fixtures: Classified “Dark Sky” compliant.

.2 Lighting shall minimize light trespass and light pollution.

2.3 EXTERIOR LIGHTING STANDARDS

.1 Lighting calculations must be made for maintained footcandle (lux) levels and submission to approval prior to order of material. Measurement of illumination level with report submitted after completion of installation.

.2 Refer to the following tables for BCIT Exterior Lighting Standards.

Table 2

BCIT Lighting Standards - Exterior					
		ILLUMINATION LEVEL		ILLUMINATING UNIFORMITY RATIO	MAXIMUM WATTAGE
	AREA USE	FC	LUX		
A	Building Entrances	10	100	n/a	20W/ft. of door width
B	Building Exit Door	3	30	n/a	n/a
C	Sidewalk	1.1	11	5:1	n/a
D	Pathways	0.5	5	5:1	n/a
E	Parking Lot - Open	1	10	4:1	n/a
F	Loading Deck	20	200	n/a	n/a
G	Roadways [1]	0.7	7	6:1	n/a

[1]Classified for the purposes of lighting as local road – intermediate use.

Suggested Luminaire Selection – Exterior	
LUMINAIRE	**APPLICATION (AREA USE #)**
LED A,B,C,D,E,G	Wall Mount Recessed Exterior LED Pot Lamp
A,B	Pole Mounted LED (16 ft.) Standard
C,D	(24 ft.)

RECOMMENDED POLE AND LUMINAIRE HEIGHTS ARE	
Pathway	14 - 16 ft; or Bollards
Sidewalks	14 – 16 ft
Parking Lot	30 ft
Roadway	24 ft

PART 3 - EXECUTION

NOT USED

END OF SECTION

APPENDIX 'D'

Selection of Luminaires - Exterior

FIXTURE PART NUMBERS MAY NOT BE THE MOST CURRENT FROM THE MANUFACTURERS. REVIEW WITH MANUFACTURER'S REPRESENTATIVE IS RECOMMENDED

PART 1 - GENERAL

1.1 SUMMARY

.1 Exterior luminaires shall be manufactured by:

- .1 Cooper Lighting
- .2 General Electric
- .3 Philips

.2 Luminaire components, voltages, and features shall be as outlined in these Standards.

.3 Exterior luminaires must be LED, 4100°K.

PART 2 - PRODUCTS

2.1 LED WALL MOUNT – SMALL

.1 Lumark 'Cross Tour'

- .1 10 watt: #XTOR1A
- .2 20 watt: #XTOR2A
- .3 30 watt: #XTOR3A
- .4 34 watt: McGraw-Edison GWC-TW4-4000K

.2 Keene 'Lytepro 16' #LP16 – Colour

2.2 LED WALL MOUNT – LARGE

.1 Lumark 'Cross Tour' with 'ARL' Refractive Lens

- .1 50 watt: #XTOR5ARL
- .2 85 watt: #XTOR9ARL
- .3 85 watt: McGraw-Edison GWC-TW4-4000K

.2 Keene 'Lytepro 16' #LP32 – Colour

2.3 LED POLE MOUNTED (16' ±)

.1 General Electric 'Evolve' Series Post Top #EPTC-OB5-41-PL-1B-DKBZ

.2 McGraw Edison 'GLeon' Small

.3 General Electric 'Evolve' LED Area Light #EASM-O-XX-F40A

2.4 LED POLE MOUNTED (24' ±)

.1 McGraw Edison 'GLeon' Large

.2 General Electric 'Evolve' LED Area Light #EAMM-O-XX-F40A

2.5 ROADWAY

.1 General Electric 'Evolve' Roadway Lighting #ERS2-0-XX-XX

2.6 POLES

.1 Pole (16 ft. ±)

- .1 Poles are to be galvanized with painted finish.
- .2 Poles are to come with standard base plate.
- .3 Poles are to be square.

.4 Pole colour to be black.

2.7 POLE (24' ±)

.1 Poles are to be galvanized with painted finish.

.2 Poles are to come with standard base plate.

.3 Poles are to be square.

.4 Pole colour to be black.

2.8 POLE ROADWAY

.1 Poles are to be galvanized with painted finish.

.2 Poles are to come with standard base plate.

.3 Poles are to be square.

.4 Pole colour to be black.

PART 3 - EXECUTION - NOT USED

END OF SECTION