

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Division 33.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-12, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
 - .2 CAN/CSA-C22.3 No. 7-10, Underground Systems.
 - .3 CAN3-C235-83(R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
 - .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
 - .2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .2 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.
 - .5 Installation to be in accordance with National Building Code of Canada (NBCC) and Local Regulations.

1.3 DEFINITIONS

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.4 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
 - .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
 - .3 Language operating requirements: provide identification nameplates and labels for control items in English.
 - .4 Electrical permit required. Pay all associated fees.
-

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00- Submittal Procedures.
 - .2 Submit for review single line electrical diagrams.
 - .3 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Nova Scotia, Canada.
 - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown 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 of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
 - .4 Quality Control: in accordance with Section 01 45 00 - Quality Control.
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.
 - .3 Submit test results of installed electrical systems and controls/instrumentation.
 - .4 Permits and fees:
 - .1 Submit to local inspection authority the necessary number of drawings and specifications for examination and approval prior to commencement of Work.
 - .2 Pay all associated fees.
 - .3 Notify Departmental Representative of changes required by local Electrical Inspection Authority prior to making changes
 - .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
 - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
 - .5 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.
-

1.6 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Territorial Act respecting manpower vocational training and qualification.
 - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 Site Meetings:
 - .1 In accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Charts.
 - .2 Site Meetings: Schedule site visits, to review Work, at stages listed.
 - .1 Once during progress of Work at 50% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within 4 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.8 SYSTEM STARTUP

- .1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.
 - .2 Arrange and pay for services of manufacturers' factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
 - .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.
-

1.9 OPERATING INSTRUCTIONS

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 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 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.
- .5 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

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. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction inspection authorities before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.
- .3 Factory assemble control panels and component assemblies. Full assembly shall be certified by a recognized certification agency, component certification only will not be accepted.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
 - .2 Control wiring and conduit: in accordance with Section 26 05 21 and 26 05 34 –
-

Wires and Cables (0 – 1000V) and Conduits, Conduit Fastenings and Conduit Fittings, respectively. Conduit, wiring and connections below 50 V which are related to control systems indicated in Electrical drawings are to be in accordance with Section 25.

2.3 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of inspection authorities and Departmental Representative.
- .2 Porcelain enamel signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for copper and aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: lamicoid 3 mm thick plastic engraving sheet matt white finish face, black core, lettering accurately aligned and engraved into core mechanically attached with double face tape
 - .2 Sizes as follows:

<u>NAMEPLATE</u>	<u>SIZES</u>		
Size 1	10 X 50mm	1 line	3mm high letters
Size 2	12 X 70mm	1 line	5mm high letters
Size 3	12 X 70mm	2 lines	3mm high letters
Size 4	20 X 90mm	1 line	8mm high letters
Size 5	20 X 90 mm	2 lines	5mm high letters
Size 6	25 X 100mm	1 line	12m high letters
<u>Size 7</u>	<u>25 X 100mm</u>	<u>2 lines</u>	<u>6mm high letters</u>

- .2 Labels: embossed plastic labels with 6mm high letters unless specified otherwise.
 - .3 Wordings on nameplates and labels to be approved by Departmental Representative prior to manufacture.
 - .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
 - .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
-

- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. XX" as directed by Departmental Representative.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage characteristics.
- .9 Transformers: indicate capacity, primary and secondary voltages.
- .10 Switchboards and Panelboards: Indicate designated name of equipment, system and voltage characteristics.

2.6 WIRING IDENTIFICATION

- .1 Identify all wiring with permanent indelible identifying markings, numbered 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.

2.7 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: 25mm wide prime colour and 20mm wide auxiliary colour.

	<u>Prime</u>	<u>Auxiliary</u>
up to 250V	Yellow	
up to 600V	Yellow	Green
<u>Other Communication Systems</u>	<u>Green</u>	<u>Blue</u>

2.8 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint indoor switchgear and distribution enclosures light gray.
-

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Complete underground systems installation in accordance with CSA C22.3 No.1 and No. 7 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50mm.
- .2 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.4 LOCATION OF OUTLETS

- .1 Locate outlets as indicated on drawings and 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 150mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 300mm, and information is given before installation.
- .4 Locate light switches on latch side of doors.
 - .1 Locate disconnect devices where indicated on the drawings.

3.5 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centre line of equipment unless specified or indicated otherwise.
 - .2 If 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: 1200mm.
 - .2 Wall receptacles:
 - .1 General: 300mm.
 - .2 Above top of continuous baseboard heater: 200mm.
 - .3 Above top of counters or counter splash backs: 175mm.
 - .4 In mechanical rooms: 1200mm.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Telephone and interphone outlets: 300mm.
 - .5 Wall mounted telephone and interphone outlets: 1200mm.
 - .6 Fire alarm stations: 1200mm.
 - .7 Fire alarm bells: 2300mm.
 - .8 Instrumentation Equipment: 1200mm.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.7 FIELD QUALITY CONTROL

- .1 Load Balance:
 - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards and dry-type transformers, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
 - .2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
 - .1 Power distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .5 Systems: fire alarm system, communications and intrusion alarm.
 - .6 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350V with a 500V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V
-

instrument.

.3 Check resistance to ground before energizing.

.3 Submit test results to Departmental Representative.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.8 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

3.9 SINGLE LINE DIAGRAM

.1 Provide and install a single line diagram under plexyglass in glazed frame, locate next to Panel "A".

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 21 - Wires and Cables (0-1000 V).

1.2 REFERENCES

- .1 CSA International
 - .1 CAN/CSA-C22.2 No. 18.4-04(R2009), Hardware For The Support Of Conduit, Tubing and Cable.
 - .2 CAN/CSA-C22.2 No.65-03(R2008), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Materials and Equipment 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.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors #10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded copper conductors.
 - .2 Clamp for copper bar.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper bar.
 - .5 Sized for conductors and bars as indicated.
- .4 Clamps or connectors for armoured cable, TECK cable, flexible conduit, as required to: CAN/CSA-C22.2 No.18.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
-

- .2 Inform Departmental Representative 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 Departmental Representative.

3.2 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and cables and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
 - .2 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
 - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 20 - Wire and Box Connectors (0-1000 V).

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA C22.2 No. 0.3-09, Test Methods For Electrical Wires and Cables.
 - .2 CAN/CSA C22.2 No. 131-07(R2012), Type TECK 90 Cable.

1.3 PRODUCT DATA

- .1 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Packaging Waste Management: remove for reuse packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 BUILDING WIRES

- .1 Conductors: stranded for #10 AWG and larger. Minimum size: #12 AWG.
- .2 Copper conductors: size as indicated, with 1000 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE and RWU90 XLPE. Use RWU90 for outdoor installations.

2.2 TECK 90 CABLE

- .1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical and to CAN/CSA C22.2 No. 131. Rated for hazardous location in areas classified as hazardous.
 - .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
 - .3 Insulation:
-

- .1 Cross-linked polyethylene XLPE.
- .2 Rating: 1000 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum.
- .6 Overall jacket: thermoplastic polyvinyl chloride, low flame spread/low gas emission (LFS/LGE), fire retardant to CSA C22.2 No. 0.3.
- .7 Fastenings:
 - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables at 1200 mm centers, unless noted otherwise, and as required by Local Authority.
 - .3 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
 - .1 Watertight, approved for TECK cable.

2.3 ARMoured CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Type: ACWU90 PVC flame retardant jacket over armour for this project wet locations.
- .5 Connectors: anti short connectors.

PART 3 - EXECUTION

3.1 GENERAL CABLE INSTALLATION

- .1 Install cable in trenches in accordance with Section 26 05 43.01 - Installation of Cables in Trenches and In Ducts.
 - .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
 - .3 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
-

- .4 Conductor length for parallel feeders to be identical.
- .5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .6 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .7 All branch circuits to have dedicated neutral conductors, common neutrals not permitted.
- .8 Seismic requirements: in accordance with Section 26 05 00 - Common Work Results - For Electrical.

3.2 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
 - .2 In underground ducts in accordance with Section 26 05 43.01 - Installation of Cables in Trenches and in Ducts.
 - .3 Provide dedicated neutral for each branch circuit.

3.3 INSTALLATION OF TECK90 CABLE (0-1000 V)

- .1 Group cables wherever possible on channels.
- .2 Group cables, on surface mounted channells where possible.
- .3 Do not secure cable to equipment pertinent to other trade.
- .4 Terminate cables and provide suitable connectors, as specified herein, where required.
- .5 Install cable, securely supported by cable clamps.

3.4 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible on channels.
- .2 Install for short (less than 3 meters) length to lighting luminaires.

PART 1 - GENERAL

1.1 REFERENCES

- .1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE 837-02, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.
- .2 CSA International
 - .1 CSAZ462-12, Workplace Electrical Safety.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Materials and Equipment 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.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect grounding equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

- .4 Packaging Waste Management: remove for reuse packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .2 Insulated grounding/bonding: green, copper conductors, RW90, size as indicated. Minimum size #12 AWG.
- .3 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .4 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Bonding jumpers, straps.
 - .5 Pressure wire connectors.
 - .6 Compression connectors.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative 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 Departmental Representative.

3.2 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Run insulated bond wire in each conduit.

- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding/bonding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7 Install flexible ground straps as required.
- .8 Install separate ground conductor to outdoor lighting standards.
- .9 Connect building structural steel and metal siding to ground by compression; copper to steel (#6 AWG). Provide suitable compression tools.
- .10 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.3 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of secondary 120/208 and 347/600 V systems.

3.4 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, fire pumps, distribution panels, outdoor lighting.

3.5 GROUNDING BUS

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room as indicated on drawings.
 - .2 Ground items of electrical equipment in electrical room and other areas, as indicated on the drawing(s), to ground bus with individual bare stranded copper connections size #2/0AWG, unless noted otherwise.
-

3.6 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 21 - Wires and Cables (0-1000 V).
- .2 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.
- .2 Hot dip galvanized (after fabrication) material for outdoor and in wet areas installation.
- .3 All site applied interior paints, coatings, adhesives, sealants, sealant primers, concrete curing compounds, etc.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Secure equipment to masonry, tile and plaster surfaces with lead anchors or nylon shields.
-

- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .4 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .5 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .6 For surface mounting of two or more conduits use channels at spacing in accordance with CSA C22.1 - latest edition.
- .7 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .8 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .9 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trades and approval of Departmental Representative.
- .11 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-12, Canadian Electrical Code, Part 1.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals 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.
- .3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 JUNCTION AND PULL BOXES

- .1 Construction: welded steel enclosure. Enclosure to provide a degree of environmental protection equal to or higher than CSA Type 3R for indoor and 4X for outdoor.
 - .2 Covers Flush Mounted: 25 mm minimum extension all around.
 - .3 Covers Surface Mounted: screw-on turned edge covers.
-

2.2 CABINETS

- .1 Construction: welded sheet steel hinged door, handle, latch lock 2 keys and catch. Enclosure to provide a degree of environmental protection equal to or higher than CSA Type 3R for indoor and 4X for outdoor.
- .2 Type T Terminal: flush overlapping sides, mounting as indicated containing sheet steel backboard.

PART 3 - EXECUTION

3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
- .3 Install terminal block as indicated in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.
- .5 Seismic requirements: in accordance with Section 26 05 00 - Common Work Results - For Electrical.

3.2 IDENTIFICATION

- .1 Equipment Identification: to Section 26 05 00- Common Work Results for Electrical.
- .2 Identification Labels: size 2 indicating system name, voltage and phase or as indicated.
- .3 All junction boxes: indicate panel and circuit number.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Section 26 27 26 - Wiring Devices.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-12, Canadian Electrical Code, Part 1.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Materials and Equipment.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
 - .2 102 mm square or larger outlet boxes as required.
 - .3 Gang boxes where wiring devices are grouped.
 - .4 Blank cover plates for boxes without wiring devices.
 - .5 347 V outlet boxes for 347 V switching devices.
 - .6 Combination boxes with barriers where outlets for more than one system are grouped.
-

2.2 GALVANIZED STEEL OUTLET BOXES

- .1 One-piece electro-galvanized construction.
- .2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .4 Extension and plaster rings for flush mounting devices in finished walls.

2.3 MASONRY BOXES

- .1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

- .1 Cast FS or FD copper-free aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.6 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 35mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
-

- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.
- .7 Use FS or FD boxes for outdoor and in wet areas installation.
- .8 Conduit fittings (condulets) shall be accessible (not concealed).
- .9 Each receptacle to have its panel and circuit number identified on lamicoid nameplate above device.
- .10 Receptacles to be installed with grounds down.
- .11 Dedicated neutrals required for all receptacle circuits.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Section 26 05 29 - Hangers and Supports for Electrical Systems.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18.1-03(R2009), Metallic Outlet Boxes.
 - .2 CSA C22.2 No. 45.1-07(R2012), Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-04(R2009), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83-M1985(R2008), Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2-06(R2011), Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA No. 18.3-12, Conduit, Tubing and Cable Fittings.
 - .7 CSA C22.2 No. 211.1-06(R2011), Rigid Types EB1 and DB2/ES2 PVC Conduit.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Place materials defined as hazardous or toxic waste in designated containers.
-

- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

PART 2 - PRODUCTS

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Rigid PVC conduit: to CSA C22.2 No. 211.2. PVC conduits that are not concrete encased shall be Schedule 40.
- .4 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 53 mm and smaller.
 - .1 Two hole steel straps for conduits larger than 53 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits in accordance with Section 26 05 29 - Hangers and Supports For Electrical Systems.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" (condulets) where 90 degrees bends for 27 mm and larger conduits, except for communications systems.
- .3 Conduit fittings (condulets) are not permitted for communications systems.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
-

- .2 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Polypropylene. Provide in all empty conduits.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
 - .2 Conceal conduits except in unfinished areas.
 - .3 Use rigid hot dipped galvanized steel threaded conduit where specified or subject to mechanical injury and in hazardous location areas.
 - .4 Use epoxy coated conduit in corrosive areas.
 - .5 Use rigid pvc conduit underground. Use DB2 ducts cast in concrete.
 - .6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment.
 - .7 Minimum conduit size for lighting and power circuits: 21 mm. Minimum conduit size for communications systems: 27 mm.
 - .8 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
 - .9 Mechanically bend steel conduit over 21 mm diameter.
 - .10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
-

- .11 Install fish cord in all empty conduits.
- .12 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .13 Dry conduits out before installing wire.
- .14 Do not secure conduits to mechanical systems piping or ducts, suspended ceiling, etc.
- .15 Provide minimum #12 AWG insulated "green" bonding conductor in all conduits. Provide suitable means to bond ends of mettalic conduit.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel.
 - .1 Install in centre one third of slab.
 - .2 Protect conduits from damage where they stub out of concrete.
-

- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.
 - .1 Use cold mastic between sleeve and conduit.
- .5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 25 mm concrete cover, unless noted otherwise.
- .7 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- .1 Run conduits 27 mm and larger below slab and encase in 75 mm concrete envelope.
 - .1 Provide 50 mm of sand over concrete envelope below floor slab.

3.7 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.8 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

PART 1 - GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for cables and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Materials and Equipment 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.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect cables from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 CABLE PROTECTION

- .1 38 x 140 mm planks pressure treated with copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

2.2 MARKERS

- .1 Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of
-

cable and duct runs.

- .2 Polyethylene warning tape over full length of cable (raceway) route. Tape width of 75 mm with 4 mil tape thickness. Test on tape to read "CAUTION BURIED ELECTRIC LINE BELOW".

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for cable installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative 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 Departmental Representative.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
 - .2 Perform tests using qualified personnel.
 - .1 Include necessary instruments and equipment.
 - .3 Check phase rotation and identify each phase conductor of each feeder.
 - .4 Check each feeder for continuity, short circuits and grounds.
 - .1 Ensure resistance to ground of circuits is not less than 50 megohms.
 - .5 Pre-acceptance tests:
 - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
 - .6 Acceptance Tests:
 - .1 Ensure that terminations and accessory equipment are disconnected.
 - .2 Ground shields, ground wires, metallic armour and conductors not under
-

- test.
- .3 High Potential (Hipot) Testing.
 - .1 Conduct hipot testing in accordance with manufacturer's recommendations.
- .4 Leakage Current Testing:
 - .1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.
 - .2 Hold maximum voltage for specified time period by manufacturer.
 - .3 Record leakage current at each step.
- .7 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test. Departmental Representative should witness test before receiving the results.
- .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Repair damage to adjacent materials caused by cables installation.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 28 - Grounding - Secondary.

1.2 REFERENCES

- .1 CSA International
 - .1 CAN/CSA-C22.2 No.47-M90(R2012), Air-Cooled Transformers (Dry Type).
 - .2 CSA C9-02(R2011), Dry-Type Transformers.
 - .3 CAN/CSA-C802.2-12, Minimum Efficiency Values for Dry Type Transformers.
- .2 National Electrical Manufacturers Association (NEMA)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for dry type transformers and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Factory test reports should be provided for all transformers.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for dry type transformers for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Materials and Equipment 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.
-

- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect dry type transformers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 DESIGN DESCRIPTION

- .1 Design 1.
 - .1 Type: ANN.
 - .2 3 phase, 600 V input, 120/208 V output, 60 Hz, rating as indicated on drawings.
 - .3 Voltage taps: standard.
 - .4 Insulation: Class 220, 150 degrees C temperature rise.
 - .5 Basic Impulse Level (BIL): standard.
 - .6 Hipot: standard.
 - .7 Average sound level: standard
 - .8 Impedance at 17 degrees C: standard
 - .9 Enclosure: CSA Type 3R, removable metal front panel.
 - .10 Mounting: ceiling.
 - .11 Finish: in accordance with Section 26 05 00 - Common Work Results for Electrical.
 - .12 Copper windings.
 - .13 Winding configuration to be as noted on drawings.
 - .14 Voltage Regulation to be 4% or better.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
 - .2 Label size: 7.
 - .3 Nameplate wording: per Power Distribution Single Line Diagram Identification.
-

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for dry type transformers installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative 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 Departmental Representative.

3.2 INSTALLATION

- .1 Mount dry type transformers as indicated.
- .2 Ensure adequate clearance around transformer for ventilation.
- .3 Install transformers in level upright position.
- .4 Remove shipping supports only after transformer is installed and just before putting into service.
- .5 Loosen isolation pad bolts until no compression is visible.
- .6 Make primary and secondary connections in accordance with wiring diagram.
- .7 Energize transformers after installation is complete.
- .8 Make conduit entry into bottom 1/3 of transformer enclosure.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
-

- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by dry type transformers installation.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 28 16.02 - Moulded Case Circuit Breakers.

1.2 REFERENCES

- .1 CSA International
 - .1 CSA C22.2 No.29-11, Panelboards and Enclosed Panelboards.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Include on drawings:
 - .1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Materials and Equipment 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.
 - .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
-

- .2 Store and protect panelboards from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/ Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
 - .2 250 and 600 V panelboards: bus and breakers rated for 10,000 A (symmetrical) interrupting capacity unless indicated otherwise on drawings.
 - .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
 - .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
 - .5 Minimum of 2 flush locks for each panel board.
 - .6 Two keys for each panelboard and key panelboards alike.
 - .7 Copper bus with neutral of same ampere rating of mains.
 - .8 Mains: suitable for bolt-on breakers.
 - .9 Trim with concealed front bolts and hinges.
 - .10 Trim and door finish: baked enamel as per colour schedule.
 - .11 Enclosure to provide a degree of environmental protection equal to or higher than CSA Type 3R.
-

2.2 BREAKERS

- .1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Departmental Representative.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

2.4 WARNING SIGNS

- .1 Provide potential electric shock and arc flash hazard warning sign in accordance with Section 26 05 00 - Common Work Results for Electrical.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative 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 Departmental Representative.
-

3.2 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical or as indicated.
- .3 Connect loads to circuits.
- .4 Connect neutral conductors to common neutral bus with respective neutral identified.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by panelboards installation.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 28 20 - Ground Fault Circuit Interrupters - Class "A".

1.2 REFERENCES

- .1 CSA International
 - .1 CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CAN/CSA C22.2 No.42.1-00(R2009), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA C22.2 No.55-M1986(R2012), Special Use Switches.
 - .4 CSA C22.2 No.111-10, General-Use Snap Switches (Bi-national standard, with UL 20).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Materials and Equipment 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.
 - .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
-

- .2 Store and protect wiring devices from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/ Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 SWITCHES

- .1 20 A, 120 V and 347 V, single pole, three-way, four-way switches to: CSA C22.2 No.55 and CSA C22.2 No.111.
- .2 Manually-operated general purpose AC switches with following features:
 - .1 Terminal holes approved for #10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 Ivory toggle.
- .3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads and heating loads.
- .4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-20R, 125 V, 15/20A, U ground, to: CSA C22.2 No.42 with following features:
 - .1 Ivory urea moulded housing.
 - .2 Suitable for #10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
 - .2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
 - .1 Ivory urea moulded housing.
 - .2 Suitable for #10 AWG for back and side wiring.
 - .3 Four back wired entrances, 2 side wiring screws.
 - .3 Other receptacles with ampacity and voltage as indicated.
-

- .4 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

- .1 Cover plates for wiring devices to: CSA C22.2 No.42.1.
- .2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .3 Galvanized steel cover plates for wiring devices mounted in flush-mounted outlet box.
- .4 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.
- .6 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

2.4 SOURCE QUALITY CONTROL

- .1 Cover plates from one manufacturer throughout project.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative 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 Departmental Representative.
-

3.2 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 for Electrical unless indicated otherwise.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results for Electrical unless indicated otherwise.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
 - .4 Install GFCI type receptacles as indicated.
- .3 Cover plates:
 - .1 Install suitable common cover plates where wiring devices are grouped.
 - .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.3 WIRING

- .1 Connect wiring devices and switches to power circuit.
- .2 Utilize an individual, dedicated neutral conductor for each power circuit. Common or shared neutrals are not permitted.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
 - .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
-

3.5 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.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 28 23 - Disconnect Switches - Fused and Non-Fused.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No. 248-00 (R2010), Low Voltage Fuses - Part 8: Class J Fuses.
 - .2 CSA C22.2 No. 248.14-00 (R2010), Low Voltage Fuses - Part 14: Supplemental Fuses.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide fuse performance data characteristics for each fuse type and size. Performance data to include: average melting time-current characteristics.
- .3 Shop Drawings:
 - .1 Provide shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Ship fuses in original containers.
- .2 Do not ship fuses installed in switchboard.
- .3 Store fuses in original containers in moisture free location.
- .4 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
-

- .2 Six spare fuses of each type and size installed.

PART 2 - PRODUCTS

2.1 FUSES - GENERAL

- .1 Fuses: product of one manufacturer.
- .2 Low-voltage Fuses, types as specified, and to be CSA certified in accordance with CSA Standard C22.2 No. 248.

2.2 FUSE TYPES

- .1 All fuses shall be high rupturing capacity (HRC) type, minimum 200kA interrupting rating (momentary RMS symmetrical).
 - .2 Class J:
 - .1 Fuses rated 1 to 600 amperes, 600 VAC, shall be CSA certified Class J in accordance with Standard C22.2 No.248.8.
 - .2 Where a time delay characteristic is required, fuses shall carry 500% of the ampere rating for not less than 10 seconds and shall be clearly labeled "time delay".
 - .3 Class CC:
 - .1 Fuses rated 1 to 30 amperes, 600 VAC, shall be CSA certified Class CC in accordance with Standard C22.2 No. 248.4.
 - .2 Where a time delay characteristic is required, fuses shall carry 200% of their ampere rating for not less than 12 seconds.
 - .4 Standard of Acceptance:
 - .1 Class J: Ferraz Shawmut type A4J (non-time delay) and AJT(time delay) and HSJ (time delay).
 - .2 Class CC: Ferraz Shawmut type ATMR 9 (non-time delay) and ADTR (time delay) and ATQR (time delay).
 - .5 Acceptable Manufactures:
 - .1 Ferraz Shawmut.
 - .2 Bussmann.
 - .3 Littlefuse.
-

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure correct fuses fitted to physically matched mounting devices.
- .3 Ensure correct fuses fitted to assigned electrical circuit.
- .4 Ensure fuse size is correctly identified on equipment.
- .5 For feeder circuit fuses, use fast acting Class J fuses unless otherwise noted.
- .6 For full voltage non-reversing motor starters, full voltage reversing motor starters, full voltage multi-speed motor starters and transformers use time delay Class J fuses.
- .7 For 600 VAC control circuits, use Class CC type fuses. Use time delay Class CC fuses upstream of control transformers and solenoids.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 24 16.01 - Panelboards Breaker Type.

1.2 REFERENCES

- .1 CSA International
 - .1 CSA C22.2 No. 5-13, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMJ-J-266-ANCE-2013).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Include time-current characteristic curves for provided breakers.
 - .4 Certificates:
 - .1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 3 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.
 - .1 Production certificate of origin must be submitted to Departmental Representative for approval.
 - .2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.
 - .3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.
 - .4 Production certificate of origin must contain:
 - .1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.
-

- .2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.
- .3 Contractor's name and address and person responsible for project.
- .4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.
- .5 Name and address of building where circuit breakers will be installed:
 - .1 Project title.
 - .2 End user's reference number.
 - .3 List of circuit breakers.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Materials and Equipment 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.
- .3 Storage and Handling Requirements:
 - .1 Store circuit breakers off ground indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect circuit breakers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/ Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers and ground-fault circuit-interrupters 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 degrees 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 3-8 times current rating.
- .5 Circuit breakers with interchangeable trips as indicated.
- .6 Circuit breakers to have minimum symmetrical rms interrupting capacity rating same as associated board. Series rating for breakers is not acceptable.

2.2 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.

2.3 MOTOR CIRCUIT PROTECTORS (MCP)

- .1 Moulded case circuit breaker to operate automatically by means of solid state tripping devices to provide instantaneous tripping for short circuit protection.
- .2 MCP tripping range to allow for starting motors direct-on-line. Adjustable range from 700% to 1700% of motor full load amps.

2.4 OPTIONAL FEATURES

- .1 Include, as indicated on drawings:
 - .1 Shunt trip.
 - .2 Auxiliary switch.
 - .3 On-off locking device.
 - .4 Handle mechanism.

2.5 ENCLOSURE

- .1 Locate and mount in enclosure as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance
-

with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative 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 Departmental Representative.

3.2 INSTALLATION

- .1 Install circuit breakers as indicated.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 27 26 - Wiring Devices.

1.2 PAYMENT

- .1 Payment for field testing of ground fault equipment performed by equipment manufacturer in accordance with Section 01 29 83 - Payment Procedures: Testing Laboratory Services.

1.3 REFERENCES

- .1 CSA International
 - .1 CAN/CSA C22.2 No.144-M91(R2011), Ground Fault Circuit Interrupters.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA PG 2.2-1999(R2009), Application Guide for Ground Fault Protection Devices for Equipment.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for ground fault circuit interrupters and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Test and Evaluation Reports: submit test report for field testing of ground fault equipment to Departmental Representative and certificate that system as installed meets criteria specified.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Operation and Maintenance Data: submit operation and maintenance data for ground fault circuit interrupters for incorporation into manual.
-

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Materials and Equipment 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.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect ground fault circuit interrupters from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/ Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA C22.2 No.144 NEMA PG 2.2.
- .2 Components comprising ground fault protective system to be of same manufacturer.

2.2 BREAKER TYPE GROUND FAULT INTERRUPTER

- .1 Single pole ground fault circuit interrupter for single phase circuit c/w test and reset facilities. Rating as indicated on drawings.
- .2 Type (2) pole ground fault circuit interupter not acceptable.

2.3 GROUND FAULT PROTECTOR UNIT

- .1 Self-contained with 15/20 A, 120 V circuit interrupter and duplex U-ground receptacle, CSA Type 5-20R, colour ivory, complete with:
 - .1 Solid state ground sensing device.
 - .2 Facility for testing and reset.
 - .3 Matching cover plate.
-

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for ground fault circuit interrupters installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative 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 Departmental Representative.

3.2 INSTALLATION

- .1 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and co-ordinate with Section 01 45 00 - Quality Control if required.
- .2 Arrange for field testing of ground fault equipment by ground fault equipment manufacturer before commissioning service.
- .3 Demonstrate simulated ground fault tests.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 28 13.01 - Fuses - Low Voltage.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA C22.2 No.4-04 (R2009), Enclosed and Dead-Front Switches (Tri-National Standard With ANCE NMX-J-162-2004 and UL 98).
 - .2 CSA C22.2 No.39-13, Fuseholder Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Separate for reuse and recycling and place in designated containers waste in accordance with Waste Management Plan.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

- .1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure Type 3R for indoor application and Type 4x for outdoor application, to CAN/CSA C22.2 No.4, size as indicated.
 - .2 Provision for padlocking in "off" switch position by three pad-locks.
 - .3 Mechanically interlocked door to prevent opening when handle in ON position.
-

- .4 Fuses: size as indicated, in accordance with Section 26 28 13.01 - Fuses - Low Voltage.
- .5 Fuseholders: to CSA C22.2 No.39 relocatable and suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

2.3 WARNING SIGNS

- .1 Provide warning signs in accordance with Section 26 05 00 - Common Work Results - For Electrical.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install disconnect switches complete with fuses if applicable, where required by CEC - latest edition and where indicated on the drawings.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCES

- .1 Standards:
 - .1 CSA C22.2 No. 14, Industrial Control Equipment.
 - .2 CSA C22.1-2012 Canadian Electrical Code Part 1.
- .2 In case of conflict, the most stringent standards shall be applied.
- .3 Apply all other standards, reference publications and amendments referred to in the standards listed above.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Include:
 - .1 Mounting method and dimensions.
 - .2 Starter size and type, pick-up voltage and time, drop-out voltage and time.
 - .3 Layout and description of identified internal and front panel components.
 - .4 Enclosure types.
 - .5 Wiring diagram for each type of starter.
 - .6 Interconnection diagrams.
 - .7 Certifications and approvals.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 26 05 00 – Common Work Results for Electrical.
- .2 Include operation and maintenance data for each type and style of starter.

1.5 EXTRA MATERIALS

- .1 Provide maintenance materials in accordance with Section 26 05 00 – Common Work Results for Electrical.
 - .2 Provide listed spare parts for each different size and type of starter:
-

- .1 3 contacts, stationary.
- .2 3 contacts, movable.
- .3 1 contacts, auxiliary.
- .4 1 control transformer.
- .5 1 operating coil.
- .6 10% of indicating lamp used.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Starters NEMA rated, as indicated on drawings.

2.2 ELECTRONIC REDUCED VOLTAGE STARTERS

- .1 Provide solid state reduced voltage starters for salt water pumps P-1 and P-2. The starters shall provide torque control for linear acceleration and deceleration (smooth and stable ramp) without external feedback.
 - .2 The starter shall be controlled by a microprocessor that continuously monitors and controls the current.
 - .3 The starter with all associated equipment and devices shall be mounted as indicated on drawings in CSA type 3R enclosure.
 - .4 Starters to be combination F.V.N.R. type with similar features as for electro-mechanical type. Solid state starters to have 6 S.C.R. power section rated at 125% of motor F.L.A. continuous and 400% motor F.L.A. for a minimum of 25s. Provide each solid state starter with synchronized transformer, S.C.R. firing control, under voltage protection, and diagnostic LED's for running status, fault, and motor overload. Control of starter to be open loop voltage control with 0-100% adjustment of starting and stopping torque and adjustable ramp time voltage of 0.5 – 60 S.
 - .5 Electrical rating:
 - .1 Input voltage: +/-10% of system nominal.
 - .2 P.I.V. rating: minimum 1500 Vac.
 - .6 Protection:
 - .1 Electronic overload protection.
 - .2 Motor phase loss, phase reversal, underload, and stall protection.
 - .3 Short circuit protection.
-

- .4 SCRs protection on fault (including shorted SCR) through isolation contactors.
- .5 The integral protective features shall be active when shorting contactor is used to bypass the SCRs during steady state operation.
- .7 Diagnostic faults and soft start status shall be displayed on a door-mounted display integral to the enclosure.
- .8 Shorting / bypass and isolating contactors:
 - .1 Shorting contractor shall close, shorting SCRs after the acceleration is complete or when bypass is engaged, and open on Stop command.
 - .2 Isolating contactors shall open, isolating soft start when they fail or when bypass is engaged, and close to normal operating mode.
 - .3 Controller unit and contactor shall have full voltage (across-the-line) starting capability. Contactors capable of carrying the motor inrush and motor full load currents.
 - .4 Overload protection shall continue to protect motor when shorting is engaged. An overload provision independent of the soft start shall be provided to protect motor in bypass mode.
 - .5 It shall not be possible to start the motor in By-Pass mode.
- .9 Accessories:
 - .1 Indicating lights: LED type.
 - .2 Auxiliary contacts as indicated plus 20% spare

2.4 CONTROL TRANSFORMER

- .1 Single phase, dry type, control transformer with primary voltage and secondary as indicated, complete with primary and secondary fuses as indicated.
- .2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 FINISHES

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

2.6 EQUIPMENT IDENTIFICATION

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

- .2 Starter designation label, white plate black letters, size 1 engraved as indicated.

2.7 ACCEPTABLE MATERIALS

- .1 Allen-Bradley.
- .2 Cutler Hammer.
- .3 Eaton.
- .4 Schneider.
- .5 Siemens.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install starters, connect power and control as indicated.
- .2 Install switches and indicating lights.
- .3 Ensure correct protective devices elements are installed.
- .4 Installation shall be in compliance with manufacturer's instructions, drawings and recommendations.
- .5 The soft start controller unit manufacturer shall provide a factory certified technical representative to supervise the testing and start-up of the soft start controller unit(s).

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical and manufacturer's instructions.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.

3.3 TRAINING

- .1 An on-site training session shall be provided by a representative of the starter manufacturer.
- .2 Training session to be scheduled with departmental representative.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 52 00 - Emergency Lighting.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C82.1-04, Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.
- .2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41-1991, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
- .3 ASTM International Inc.
 - .1 ASTM F 1137-00(2006), Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .4 Canadian Standards Association (CSA International)
- .5 ICES-005-07, Radio Frequency Lighting Devices.
- .6 Underwriters' Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals 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 where specified, for approval by Departmental Representative.
 - .3 Photometric data to include: VCP Table where applicable spacing criterion; 5 plane candlepower summary and lumen ratings.
 - .3 Quality assurance submittals: provide following in accordance with Section 01 45 00 - Quality Control.
-

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

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Materials and Equipment.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return packaging materials 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 Disposal and recycling of fluorescent lamps as per local regulations.
- .6 Disposal of old PCB filled ballasts.

PART 2 - PRODUCTS

2.1 LAMPS

- .1 Refer to Luminaire Schedules on drawings.
 - .2 The lamp wattage, rated life, initial lumens, and mean lumens shall be as follows:
 - .1 32W T8 lamps: Rated Life 20,600 hours. Initial Lumens: 3100. Mean Lumens 2950.
 - .2 LED Lamps: Rated Life: 50,000 hours; lumen output refer to Luminaire Schedules.
 - .3 The lamp colour and CRI index as indicated on drawings.
 - .4 Acceptable Manufacturers:
 - .1 General Electric.
 - .2 Osram/Sylvania.
 - .3 Philips.
-

2.1 BALLASTS

- .1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic instant start design FB2.
 - .1 Rating: 120 V, 60 Hz, for use with 2-32 W, T8 lamps.
 - .2 RFI/EMI suppression circuit to: FCC (CFR47) Part 18, sub-part C, Class A and Part 15, sub-part B, Class B.
 - .3 totally encased and designed for 40°C ambient temperature.
 - .4 Power factor: minimum 99% with 95% of rated lamp lunens.
 - .5 Crest factor: 1.6 maximum current, 2.0 maximum voltage.
 - .6 Harmonics: 10% maximum THD, including 49th for electronic discrete and hybrid ballasts.
 - .7 Operating frequency of electronic ballaxst: 21 khz minimum.
 - .8 Total Circuit Power: 56 Watts.
 - .9 Ballast Factor: 0.88.
 - .10 Sound rated: Class A.
 - .11 Mounting: integral with luminaire.
 - .12 Ballasts shall be NEMA premium quality (no substitutes) and CEE specifications compliant.
 - .13 Ballast to operate 2 lamps, as required.
- .2 LED Driver:
 - .1 Rating: 120 V, 60 Hz, for LED indoor and wall pack fixtures; 347 V, 60 Hz, for the LED outdoor fixtures.
 - .2 Designed for 40°C ambient temperature.
 - .3 Mounting: integral with luminaire.
 - .4 Colour temperature and colour rendering index (CRI): refer to Luminaire Schedule.

2.2 FINISHES

- .1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.3 OPTICAL CONTROL DEVICES

- .1 As indicated on drawings.

2.4 LUMINAIRES

- .1 As indicated in Luminaire Schedule.

2.5 SURGE PROTECTION DEVICES

- .1 LED outdoor Area Luminaires shall be completed with surge protection devices.
-

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Locate and install luminaires as indicated.
- .2 Provide adequate support to suit ceiling system.

3.2 WIRING

- .1 Connect luminaires to lighting circuits.

3.3 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations support luminaires independently of ceiling.

3.4 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 21 - Wires and Cables (0-1000 V).
- .2 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .3 Section 26 50 00 - Lighting.

1.2 REFERENCES

- .1 CSA International
 - .1 CSA C22.2 No.141-10, Emergency Lighting Equipment.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for emergency lighting and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for emergency lighting for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Materials and Equipment 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.
 - .3 Storage and Handling Requirements:
 - .1 Store materials off ground indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect emergency lighting from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
-

- .4 Packaging Waste Management: remove for reuse and return of packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/ Demolition Waste Management and Disposal.

1.6 WARRANTY

- .1 For batteries in this Section 26 52 00 - Emergency Lighting, 12 months warranty period is extended to 120 months. Battery shall be pro-rated after five (5) years.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 Emergency lighting equipment: to CSA C22.2 No.141.
- .2 Supply voltage: 120/347 VAC input, field selectable.
- .3 Operating time: 30 minutes, as indicated on drawings.
- .4 Battery: sealed, maintenance free.
- .5 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.
- .6 Solid state transfer circuit.
- .7 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .8 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.
- .9 Auxiliary equipment:
 - .1 Test switch.
 - .2 Time delay relay.
 - .3 Battery disconnect device.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for emergency lighting
-

installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative 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 Departmental Representative.

3.2 INSTALLATION

- .1 Install unit equipment.
- .2 Test and demonstrate successfully the operation of all emergency lighting. Test each unit for 30 minutes on emergency.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
-

- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by emergency lighting installation.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 52 00 - Emergency Lighting.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.141-10, Emergency Lighting Equipment.
 - .2 CSA C860-11, Performance of Internally-Lighted Exit Signs.
- .2 National Building Code of Canada (NBCC)
 - .1 NRCC NBCC-2010.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit WHMIS MSDS - Material Safety Data Sheets
- .4 Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 WARRANTY

- .1 For batteries in this Section 26 53 00 - Exit Signs: 12 months warranty period is extended to 120 months. Battery shall be pro-rated after five (5) years.
-

PART 2 - PRODUCTS

2.1 SELF-POWERED UNITS

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860.
 - .2 Housing: extruded aluminum housing, brush aluminum finish.
 - .3 Face and back plates: extruded aluminum.
 - .4 Lamps: one LED-1.8W, 12 V DC.
 - .5 Use pictographs type with running person with green colour in accordance with NBCC.
 - .6 Face plate to remain captive for relamping.
 - .7 Supply voltage: 120/347 VAC input, field selectable.
 - .8 Output voltage: 12 V dc.
 - .9 Operating time: 30 minutes.
 - .10 Recharge time: 12 hours.
 - .11 Battery: sealed, maintenance free.
 - .12 Charger: solid state, voltage/current regulated, inverse temperature compensated, short circuit protected, with regulated output of plus or minus 0.01 V for plus or minus 10% V input variation.
 - .13 Solid state transfer circuit.
 - .14 Mounting: suitable for universal mounting directly on junction box and c/w knockouts for conduit.
 - .1 Removable or hinged front panel for easy access to batteries.
 - .15 Arrow: Knock-outs.
-

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install exit lights to manufacturer's recommendations, listing requirements, NBCC standard and local regulatory requirements.
- .2 Connect fixtures to exit light circuits.
- .3 Ensure that exit light circuit breaker is locked in on position.

3.3 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.