

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section covers items common to all Sections including Division 26. This Section supplement requirements of Division 1.

1.2 REFERENCES

- .1 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.
- .2 Reference Standards:
 - .1 CSA Group
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.
 - .2 CAN3-C235-83(R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
 - .2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.
 - .3 FRE Above Ground Conduit system recognized by the Canadian Electrical Code Articles 12-1200 to 12-1220 as an approved conduit material.
CSA certified by Bulletin 1089A under the listing number LR 28032, class 1833.

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 and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit for review single line electrical diagrams under plexiglass and locate as indicated:
 - .1 Electrical distribution system.
- .4 Shop drawings:
 - .1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping and other items that must be shown to ensure coordinated installation.
 - .2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
 - .3 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.
 - .4 Submit required copies of 600 x 600 mm minimum size drawings and product data to authority having jurisdiction and inspection authorities.

- .5 If changes are required, notify Departmental Representative of these changes before they are made.
- .5 Certificates:
 - .1 Provide CSA certified equipment.
 - .2 Where CSA certified equipment is not available, submit such equipment to authority having jurisdiction for special approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract.
 - .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.
- .6 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.
- .7 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .8 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
 - .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 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
 - .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect from nicks, scratches, and blemishes.

- .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 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 labels for control items in English.

2.2 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Material and equipment to be CSA certified. Where CSA certified material or equipment are not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .3 Factory assemble panels and component assemblies.

2.3 EQUIPMENT AND CONTROLS

- .1 Verify installation of equipment and controls.
- .2 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections.

2.4 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction or inspection authorities.

2.5 WIRING TERMINATIONS

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

2.6 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: lamacoid 3 mm thick plastic engraving sheet, black face, white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
 - .2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters

Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per 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. " 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.
- .9 Transformers: indicate capacity, primary and secondary voltages.

2.7 WIRING IDENTIFICATION

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

2.8 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 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 2 mm wide auxiliary colour.

Prime	Auxiliary	
up to 250 V	Yellow	
up to 600 V	Yellow	Green

2.9 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 distribution enclosures light gray.

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 EQUIPMENT REPLACEMENT

- .1 All replacement work of Electrical Distribution and/or critical equipment required shutdown shall require the following (before proceeding with work):
 - .1 Electrical Contractor to submit three (3) weeks in advance to Departmental Representative and Consultant sequence of events in writing as Shop Drawing for review.
 - .2 Electrical Contractor to proceed with work only upon written approval from Departmental Representative and Consultant.

3.3 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

3.4 NAMEPLATES AND LABELS

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

3.5 CONDUIT AND CABLE INSTALLATION

- .1 Refer to drawings details for FRE conduit installation.

3.6 LOCATION OF OUTLETS

- .1 Locate outlets as indicated on drawings.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.8 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 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core 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 Insulation resistance testing:

- .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of 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 - ACTION AND INFORMATIONAL 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.

3.9 SYSTEM STARTUP

- .1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .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.

3.10 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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section covers items common to Sections of Division 26. This Section supplement requirements of Division 1.

1.2 REFERENCES

- .1 CSA International
 - .1 CAN/CSA-C22.2 No.18-98(R2003), Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CAN/CSA-C22.2 No.65-03(R2008), Wire Connectors (Tri-National Standard with UL 486A-486B and NMJ-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 - Common Product Requirements 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 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.

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 NEMA to consist of:
 - .1 Connector body and stud clamp for stranded copper conductors.
 - .2 Clamp for stranded copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
 - .5 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable, TECK cable aluminum sheathed cable, flexible conduit, non-metallic sheathed cable 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:
 - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
 - .2 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.
 - .3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
 - .4 Install bushing stud connectors in accordance with NEMA.

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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section covers items common to Sections of Division 26. This Section supplement requirements of Division 1.

1.2 PRODUCT DATA

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

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 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, Jacketted.
- .3 Copper conductors: size as indicated, with thermoplastic insulation type TWH rated at 600 V.
- .4 Neutral supported cable: 1, 2, 3 phase insulated conductors of Copper and one neutral conductor of Copper steel reinforced, size as indicated.

2.2 CABLE IDENTIFICATION

- .1 Cables to be identified with wire markers.
- .2 Machine printed self laminating label type.
- .3 Thermal transfer type with printable area and translucent vinyl film.

2.3 CONDUCTORS IN CONDUIT:

- .1 Type: RW90, RWU90
- .2 Conductors for panel and branch circuits:
 - .1 Solid copper #10 AWG and smaller
 - .2 Stranded copper #8 AWG and larger.
 - .3 Sized as required (minimum #12 AWG).

- .3 Insulation:
 - .1 Cross link polyethylene (XLPE), 90°C.
- .4 Configuration:
 - .1 Single conductor.
- .5 Voltage Rating: 600V.
- .6 Certification:
 - .1 CSA C22.22 No. 38 latest revision.

2.4 ARMOURED CABLE AC90 (BX)

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90 - lead sheath over cable assembly and under armour.
- .3 Armour: interlocking type fabricated from galvanized steel strip.
- .4 Type: PVC flame retardant jacket over thermoplastic armour and compliant to applicable Building Code classification for this project.
- .5 Connectors: anti short connectors.

2.5 ARMOURED CABLE TECK 90

- .1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper as indicated, size as indicated.
- .3 Insulation:
 - .1 Cross-linked polyethylene XLPE.
 - .2 Rating: 600 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking galvanized steel.
- .6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.
- .7 Fastenings:
 - .1 One hole aluminum 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 1500 mm centers.
 - .3 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
 - .1 Watertight approved for TECK cable.

2.6 ALUMINUM SHEATHED CABLE

- .1 Type: RA-90 (Corflex)
- .2 Conductors:
 - .1 Solid copper #10 AWG and smaller.
 - .2 Stranded copper #8 AWG and larger.

- .3 Sized as required (minimum #12 AWG).
- .3 Insulation:
 - .1 Cross link polyethylene (XLPE), 90°C. (194°F).
- .4 Configuration:
 - .1 Single or multi-conductor as required.
- .5 Voltage Rating: 600V.
- .6 Aluminum Sheath:
 - .1 Liquid and vapour tight solid corrugation.
- .7 Outer Jacket:
 - .1 Polyvinyl chloride (PVC), -40°C (-40°F).
 - .2 Low flame spread (LFS).
 - .3 Low gas emission (LGE).
- .8 Fire Rating: FT4, AG14.
- .9 Certification:
 - .1 CSA C22.22 No. 123 or latest revision.

2.7 LOW VOLTAGE CONTROL CABLES

- .1 Type: LVT.
- .2 Conductors:
 - .1 Solid copper #18 AWG.
- .3 Insulation:
 - .1 Thermoplastic, colour coded.
- .4 Configuration:
 - .1 Single, two conductors – parallel.
 - .2 Three or more conductors – twisted.
- .5 Voltage Rating: 30V.
- .6 Outer Jacket:
 - .1 Thermoplastic.
- .7 Certification:
 - .1 CSA C22.22 No. 35.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative over installation.
- .3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

- .1 Install cables for feeders or branch circuits in raceways, wireways or trenches.
- .2 Prevent over-heating by induction in accordance with rule 12-3024(7) and 12-3024(8) and Appendix B Canadian Electric Code, Part 1 where single conductor cables connect to boxes and cabinets.
- .3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .4 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .5 Conductor length for parallel feeders to be identical.
- .6 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .7 Wiring in deck shed walls and buildings walls: typically drop or loop vertically from above. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .8 Provide mechanical protection for cables where cables are turned up above the floor through sleeves or slots. Provide channels, angle sills or rigid conduit sleeves which protrude at least 150 mm above the finished floor.
- .9 Support on channels where cables are grouped and not run in tray.
- .10 Run cables parallel to the lines of the building.
- .11 Bends to be concentric.
- .12 Seal cables which penetrate air barrier and vapour boxes to barrier and boxes in Lockhouse or Maintenance Garages.

3.3 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.

3.4 INSTALLATION OF TECK90 CABLE (0 -600 V)

- .1 Group cables wherever possible on channels.
- .2 Install cable concealed, securely supported by staples.

3.5 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible on channels.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section covers items common to Sections of Division 26. This Section supplement requirements of Division 1.

1.2 REFERENCES

- .1 CSA Group
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.
 - .2 CSA C22.2 No.41-13, Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).
 - .3 CSA C22.2 No.65-13, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

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 connectors and terminations 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 connectors and terminations for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect connectors and terminations from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

- .1 Copper long barrel compression connectors to CSA C22.2 No.65 as required sized for conductors.

- .2 2, 3, 4 way joint boxes dry location type inside buildings in accordance with Section 26 05 33 - Raceway and Boxes for Electrical Systems.

2.2 FIBER GLASS ACCESSORIES

- .1 Features
 - .1 Maintenance free and corrosion resistant.
 - .2 Constructed of either fiberglass reinforced polyester or
 - .3 thermoplastic polymer that can withstand continuous temperatures from -45°C to 125°C.

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 connectors and terminations 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 stress cones, terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2No.41.

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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section covers items common to Sections of Division 26. This Section supplement requirements of Division 1.

1.2 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.

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 grounding equipment 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 grounding equipment for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location 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.

Part 2 Products

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as required to electrically conductive bridge structure.
- .2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as required.
- .3 Rod electrodes: copper clad steel 19 mm diameter by minimum 3 m long.

- .4 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.
- .5 Insulated grounding conductors: green, copper conductors, size as indicated.
- .6 Ground bus: copper, size as required, complete with insulated supports, fastenings, connectors.
- .7 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 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire 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.
 - .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. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 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.
- .8 Install separate ground conductor to outdoor lighting standards.
- .9 Connect bridge structural steel to ground by welding copper to steel.
- .10 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .11 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end and load end.
- .12 Ground secondary service pedestals.

3.3 MAINTENANCE HOLES

- .1 Install conveniently located grounding stud, electrode, size as indicated stranded copper conductor in each maintenance hole.
- .2 Install ground rod in each maintenance hole so that top projects through bottom of maintenance hole. Provide with lug to which grounding connection can be made. Confirm ground resistance meets or exceeds Canadian Electrical Code minimum requirements.

3.4 ELECTRODES

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install water meter shunt.
- .3 Install rod electrodes and make grounding connections as indicated.
- .4 Bond separate, multiple electrodes together.
- .5 Use size 3/0 AWG copper conductors for connections to electrodes.
- .6 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.5 SYSTEM AND CIRCUIT GROUNDING

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

3.6 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchboards, frames of motors, starters, control panels, bridge steel work, generators, distribution panels, outdoor lighting, cable trays.

3.7 GROUNDING BUS

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical rooms.

3.8 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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section covers items common to Sections of Division 26. This Section supplement requirements of Division 1.

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 hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect hangers and supports from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted, suspended in bridge structure, walls and ceilings.

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 hangers and supports installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .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 Secure equipment to solid structure.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 For surface mounting of two or more conduits use channels as per CEC spacing.
- .4 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .5 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .6 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .7 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .8 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

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.

END OF SECTION

- .1 General
- 1.2 RELATED REQUIREMENTS**
 - .1 This Section covers items common to Sections of Division 26. This Section supplement requirements of Division 1.
- 1.3 REFERENCES**
 - .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.
- 1.4 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.
- Part 2 Products**
- 2.1 JUNCTION AND PULL BOXES**
 - .1 Construction: welded steel enclosure.
 - .2 Covers Flush Mounted: 25 mm minimum extension all around.
 - .3 Covers Surface Mounted: screw-on turned edge covers.
 - .4 PVC junction boxes for outdoor installations
- 2.2 NON-METALLIC JUNCTION BOXES**
 - .1 Maintenance free and corrosion resistant.
 - .2 Bases and covers are made from polycarbonate that can withstand continuous temperatures from - 50°C to 80°C.
 - .3 Cover screw holes in corners are outside of the gasket area.
 - .4 Continuous gaskets made of polyurethane foam.
- 2.3 JUNCTION, PULL BOXES**
 - .1 Install pull boxes in inconspicuous but accessible locations.
 - .2 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.
- 2.4 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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section covers items common to Sections of Division 26. This Section supplement requirements of Division 1.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.

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 - Common Product Requirements.

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.
- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

2.3 CONDUIT BOXES

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

2.4 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE - GENERAL INDOORS

- .1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.5 FITTINGS – GENERAL INDOORS

- .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 [35]mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

2.6 SERVICE FITTINGS GENERAL INDOORS

- .1 'High tension' receptacle fitting made of 2 piece die-cast aluminum with brushed aluminum housing finish for 1 single, 1 duplex, two duplex receptacles. Bottom plate with two knockouts for centered or offset installation. 12 x 102 mm extension piece as indicated.

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 and armoured cable connections. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems boxes as required.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 This Section covers items common to Sections of Division 26. This Section supplement requirements of Division 1.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).
 - .7 FRE Above Ground Conduit system recognized by the Canadian Electrical Code Articles 12-1200 to 12-1220 as an approved conduit material.
CSA certified by Bulletin 1089A under the listing number LR 28032.

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.

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 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings and expanded ends.
- .4 Rigid pvc conduit: to CSA C22.2 No. 211.2.
- .5 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.
- .6 Flexible pvc conduit: to CAN/CSA-C22.2 No. 227.3 (R2010).

- .7 FRE Above Ground Conduit system products manufactured from quality thermosetting epoxy resin and glass fiber reinforcement.
- .8 FRE Above Ground Conduit system products specifically formulated for enhanced resistance to ultra violet rays.

2.2 THERMAL EXPANSION

- .1 Flexible metal conduit to have low thermal expansion min 40% lower than P.V.C. for lower number of expansion joints.
- .2 Flexible metal conduit coefficient of thermal expansion as a low as 0.00001.37 in/in/F degree.

2.3 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
 - .1 Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1500 mm on centre.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 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" where 90 degrees bends for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

- .1 Polypropylene.

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 mechanical and electrical service rooms or in unfinished areas.
- .3 Use rigid galvanized steel threaded conduit where required.
- .4 Use epoxy coated conduit underground where required.
- .5 Use electrical metallic tubing (EMT) except in bridge structure or cast concrete above 2.4 m not subject to mechanical injury.
- .6 Use rigid pvc conduit underground.
- .7 Use liquid tight flexible metal conduit for connection vibrating equipment in damp, wet or corrosive locations.
- .8 Minimum conduit size for lighting and power circuits: 19 mm.
- .9 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .10 Mechanically bend steel conduit over 19 mm diameter.
- .11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .12 Install fish cord in empty conduits.
- .13 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .14 Dry conduits out before installing wire.

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 Do not pass conduits through structural members except as indicated.
- .5 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.
- .6 Do not locate conduits within 300mm of flues, steam or hot water lines.
- .7 When a conduit can be run surface, it shall be primed and painted with two coats to match the wall.

3.4 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel.
 - .1 Install in centre one third of slab.
- .2 Do not strap directly to parallel reinforcing steel. Strap to reinforcing steel perpendicular to conduit.
- .3 Protect conduits from damage where they stub out of concrete.
- .4 Install sleeves where conduits pass through slab or wall.

- .5 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.
 - .1 Use cold mastic between sleeve and conduit.
- .6 Conduits in slabs: minimum slab thickness 4 times conduit diameter.
- .7 Encase conduits completely in concrete with minimum 25 mm concrete cover.
- .8 Organize conduits in slab to minimize cross-overs.
- .9 Obtain approval from Departmental Representative:
 - .1 Where conduits are spaced closer than 3 diameters.
 - .2 For conduits greater than 53mm diameter.
- .10 Protect conduits from damage where they stub out of concrete.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- .1 Run conduits 25 mm and larger below slab and encase in 75 mm concrete envelope.
 - .1 Provide 50 mm of sand over concrete envelope below floor slab.
- .2 Installation of conduits in cast-in-place slabs on grade is acceptable for feeding free-standing equipment only. Installation of conduits in cast-in-place slabs on grade shall not be permitted for any other application.

3.7 CONDUITS UNDERGROUND

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

3.8 INSTALLATION OF EMT CONDUIT

- .1 Use EMT strictly in accordance with Rules 12-1400 to 12-1412 inclusive of CEC.

3.9 INSTALLATION OF RIGID METAL CONDUIT

- .1 Touch up damage to epoxy finish on rigid conduit fittings with touch-up paint supplied by manufacturer. Paint exposed threads on rigid conduit with epoxy paint.

3.10 INSTALLATION OF RIGID PVC CONDUIT

- .1 Use strictly in accordance with Rules 12-1100 inclusive of CEC.
- .2 When not encased in concrete:
 - .1 Provide expansion joints and follow manufacturer's recommendations and code requirements with respect to expansion/contraction, particularly where temperature variations are anticipated.
 - .2 Install conduits loosely with straps and clamps to allow movement.

3.11 INSTALLATION OF LIQUID TIGHT FLEXIBLE CONDUIT

- .1 Provide a separate ground conductor within flexible conduit, bonded to motor frames and system ground.
- .2 Install conduit to prevent liquids draining to connectors.

3.12 INSTALLATION OF FRE CONDUIT

- .1 Hanger support criteria:
 - .1 The following factors to be considered in the selection of conduit hangers:
 - .1 The hangers should have a minimum support surface width of 2 in. or 50.8 mm for adequate load bearing capability. Sharp edges and point contacts must be avoided.
 - .2 The commercially available grid type of conduit support hanger designed for non-metallic conduits is recommended.
 - .3 Minimize abrasion and wear at the duct and hanger interface, the materials should be of the same or similar composition and hardness. Provide premium quality fiberglass bridge hangers available.
 - .4 The hanger opening should be such as to allow free and unrestricted movement of the conduit during installation and during thermal expansion and contraction. The openings should not, however, be so large as to allow the passage of the enlarged conduit bell end, Double Bell coupling, O-Ring expansion joints or Split stop rings.
- .2 Grid Type Hangers:
 - .1 The grid type hangers are designed such that each conduit run is individually supported and isolated from the adjacent conduit. In this way, each conduit carries only its own weight and the internal cable weight but not the weight of any other conduit in the conduit bank.
- .3 Vibration Effects:
 - .1 Provide adequate provisions for bridge structures subject to the transmission of vibrations from the road surfaces to the conduit runs Adequate provisions must be made in the use of threaded fasteners and specified fastening torque, lock nuts, lock washers and thread sealants to ensure the hanger's integrity.
- .4 Vertical Loading:
 - .1 Conform to manufacturer specifications.
- .5 Hanger Orientation:
 - .1 Hangers should be installed at right angles to the duct run, and in line with each other to avoid bends and kinks in the conduit run.
- .6 Span Calculations:
 - .1 To be installed as per manufacturer recommendations.
- .7 O-Ring expansion joint designs & applications:
 - .1 O-Ring expansion joints for use in bridge crossing applications. A silicone O-Ring to be used in sealing the unit to keep out dirt and water while maintaining freedom of movement. The unit to employ retaining rings to contain the O-Ring seal and to prevent the sleeve from accidentally disengaging should it be extended too far.
 - .2 Expansion and contraction of the conduit shall be greater and independent of any expansion and contraction in the bridge structure. An O-Ring expansion joint shall be provided for every 200 ft. or 60.96 m of conduit run to adequately control motion. To ensure that each expansion joint works independently from the others, the conduit shall be securely braced at each 200 ft. or 60.96 m interval.

3.13 CONDUIT AND CABLE IDENTIFICATION

- .1 As per corresponding section.

3.14 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.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for low voltage control system designed to provide remote switching of lighting loads by use of:
 - .1 Low voltage momentary contact switches.
- .2 Related Requirements
 - .1 This Section covers items common to Sections of Division 26. This Section supplement requirements of Division 1.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Closeout Submittals:
 - .1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Test reports:
 - .1 Submit certified test reports indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Manufacturer's Instructions: submit manufacturer's installation instructions.
 - .4 Manufacturer's Field Reports: manufacturer's field reports specified.

1.3 DELIVERY, STORAGE, AND HANDLING

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

Part 2 Products

2.1 MATERIALS

- .1 Relays Lighting control relays shall be mechanically latching and shall come complete with a manual ON/OFF switch. The mechanical switch shall continuously display the true state of the relay's internal contacts.
 - .1 Single pole relays shall be rated and UL/CSA listed for 120, 277 and 347 VAC lighting loads at 20 amps.
 - .2 Double pole relays shall be rated and UL listed for 208, 240 or 480 VAC and CSA for up to 347 VAC lighting loads at 20 amps.
- .2 The relays shall have a label indicating the short circuit fault current rating. The single pole relays shall have passed U/L 508 short circuit tests at 14,000 amperes, the 2-pole relays shall be rated at 5000 amperes.
- .3 Each lighting control relay shall be capable of controlling lighting loads and have an inrush capability of 3000 amperes. Relays shall be complete with a 5 year Manufacturer's Limited Warranty.
- .4 Lighting control relays shall include captive screw terminals for both the line voltage and the low voltage connections. Switching the relay shall be accomplished with ONE signal wire and a common return. The signal wire shall be able to signal ON and OFF and shall carry status current that indicates if the relay is ON or OFF.

2.2 PRE-ASSEMBLED RELAY PANELS

- .1 Where indicated on the drawings, provide a factory pre-assembled relay panel. The panel shall be for surface or flush installation, with a hinged door assembly as required.
- .2 The panel shall be factory pre-assembled; ETL certified to UL/CSA standards, with capacities for 1 pole or 2 pole relays as required.
- .3 Panel shall include the following pre-assembled and pre-wired:
 - .1 Suitable divider separating class 1 and class 2 compartments
 - .2 Control transformer, UL/CSA approved for class 2 circuits.
 - .3 8 or 16 single pole relays, or 4 or 8 2-pole relays as required to switch circuits shown on plans or schedules.
 - .4 External control devices as required.

2.3 CONTROL ELECTRONICS

- .1 The central controller shall be field adjustable and shall have the following features:
 - .1 8 outputs; each individually programmable
 - .2 7 assignable programs, 64 events per program
 - .3 32 annual holiday schedules
 - .4 Power loss protection: 7 days for time & indefinite for program memory
 - .5 Astronomic programming
 - .6 Automatic daylight savings and leap year adjustment (selectable)
 - .7 Time-out function. Controller shall be capable of monitoring connected relays. Should a relay be switched ON the output shall switch OFF after a preset time
 - .8 Group override switch is supplied that can be set to switch all or some of the outputs ON or OFF.

- .2 If required, photometric sensor shall be connected to the photo controller to provide up to 8 independent channels of light level control. Sensor range is 1 to 6000 footcandles.

2.4 WALL SWITCHES

- .1 Switch modules shall be available with 1, 2, 3 or 4 switches per gang and shall fit into standard 'Decora' style switch plates.
- .2 Individual switches shall include an integral LED to indicate both ON and OFF states (red=ON, green=OFF)..Switches can be connected directly to relays or to system switch inputs.
- .3 Each switch shall be clearly identified with a paper switch label. The label shall be held in place with a clear plastic cap and shall be field replaceable should the operation of the switch change. Permanently etched switches are not acceptable.
- .4 Switches shall have color coded captive screw terminals. Use #18 AWG solid conductors.

2.5 DAYLIGHT SENSORS

- .1 Provide where required an exterior photometric sensor capable of sensing from 1-60,000 lux. The sensor shall connect to the panel-mounted control unit using two #18 AWG wires.
- .2 The ambient light level shall be continuously displayed in either foot candles or lux on the controller's LCD. Set point adjustments shall be easy to set using the base controller's integral keypad
- .3 One exterior sensor shall permit different relays to switch at different light levels. Lights shall be controlled by 'sensor only' or by a combination of time & light level.

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 datasheet.

3.2 INSTALLATION

- .1 Relay panel and conduit
 - .1 Ensure that conduit for line voltage wires enters panel in line voltage areas and conduit for low voltage control wires enters panel on low voltage areas. Check manufacturer's drawings for location of line and low voltage areas.
- .2 Low Voltage Wiring
 - .1 For low voltage wiring, provide wire type as recommended by the manufacturer. Adhere to recommendations as to maximum wire length and quantity of relays per switch.
- .3 Line Voltage Wiring
 - .1 Use wire gauges #12AWG as appropriately sized for the branch circuit.

3.3 FIELD QUALITY CONTROL

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

- .2 Actuate control units in presence of Departmental Representative to demonstrate lighting circuits are controlled as designated.
- .3 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.

3.4 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section covers items common to Sections of Division 26. This Section supplement requirements of Division 1.

1.2 REFERENCES

- .1 CSA International
 - .1 CAN/CSA-C22.2 No.47-M90(R2007), Air-Cooled Transformers (Dry Type).
 - .2 CSA C9-02(R2007), Dry-Type Transformers.
 - .3 CAN/CSA-C802.2-06, 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.

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 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location, 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.

Part 2 Products

2.1 DESIGN DESCRIPTION

- .1 Design.
 - .1 Type: ANN.
 - .2 3 phase, kVA as indicated on drawings, 600V input, 120/208 V output, 60 Hz.

- .3 Voltage taps: 2x2.5% FCAN and 2x2.5% FCBN.
- .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: NEMA, removable metal front panel.
- .10 Mounting: as indicated.
- .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 Harmonic Mitigating Phase Shifting transformers as indicated on drawings.
- .15 KL-Rated Transformers as indicated on drawings.
- .16 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.

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 above 75 kVA on floor.
- .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.
- .9 Outdoor transformers to be installed in ventilated enclosure NEMA 4X or Fiber Glass enclosure 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.

3.4 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section covers items common to Sections of Division 26. This Section supplement requirements of Division 1.

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 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location 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.

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 208V and 600V panelboards: bus and breakers rated for 14 or 65 kA (symmetrical) interrupting capacity or as indicated.
- .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.
- .11 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.

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.

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.
 - .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 Install surface mounted panelboards in buildings on plywood backboards in accordance with Section 06 10 00 - Rough Carpentry. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical or as indicated.
- .4 Mount outdoor panelboards inside Fiber Glass enclosure or NEMA 4X rated enclosure as indicated.
- .5 Connect loads to circuits.
- .6 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.

3.4 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section covers items common to Sections of Division 26. This Section supplement requirements of Division 1.

1.2 REFERENCES

- .1 CSA International
 - .1 CAN/CSA C22.2 No.94.1-07, Enclosures for Electrical Equipment, Non Environment Considerations.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA 250-2008, Enclosures for Electrical Equipment (1000 Volts Maximum).
- .3 The Munsell System of Colour Notation

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 electrical cabinets and enclosures 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 electrical cabinets and enclosures for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect electrical cabinets and enclosures from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

- .1 Enclosure constructed with 2.7 mm thick minimum steel, with weather and corrosion resistant finish to CAN/CSA C22.2, Munsell Notation 7.5GY3.5/1.5, size as indicated.

- .2 Entire enclosure to be capable of withstanding maximum impact force of 86 MN/m² area without rupture of material.
- .3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.
- .4 Equip enclosure with hot dipped galvanized mounting rails 1m adjustable horizontally and vertically to enable mounting of equipment at any location within housing.
 - .1 Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment.
 - .2 Holes in side panel flanges in 60 mm increments for vertical adjustment.
- .5 Cover: tamperproof, bolt-on, domed to shed water.
- .6 Door: 3 point latching, with padlocking means.
- .7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, and vermin.
- .8 Enclosure construction such as to allow configuration of single or ganged enclosures.
- .9 Enclosure capable of being shipped in knocked-down condition.
- .10 CSA approved

2.2

FIBERGLASS ENCLOSURES:

- .1 Enclosures shall be maintenance free and corrosion resistant.
- .2 Bases and covers shall be made from hot compression molded halogen free, self-extinguishing fiberglass reinforced polyester (FRP) that can withstand continuous temperatures up to -50°C to 70°C and momentary exposure to 150°C.
- .3 Windows shall be made from 1/4" transparent Lexan.
- .4 Threaded studs (min 4) shall be molded in for attachment of mounting plates and frames.
- .5 Enclosures Shall be easily modified to customer specifications.
- .6 Gaskets to be made from continuously poured polyurethane foam.
- .7 Enclosures rating approved for CSA 4X.
- .8 Double doors and lockable with two sets of keys
- .9 Suitable for bottom feed installation.
- .10 Sloped top cover rounded formed edges design to avoid accumulation of water and debris.
- .11 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, and vermin.
- .12 CSA approved

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 electrical cabinet and enclosure 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 Assemble enclosure in accordance with manufacturer's instructions and securely mount on building structure with channels, supports and fastenings.
- .2 Mount equipment in enclosure.
- .3 Label electrical cabinets and enclosure to Section 26 05 00 - Common Work Results for Electrical.

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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section covers items common to Sections of Divisions 26. This Section supplement requirements of Division 1.

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(R2008), 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 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location 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.

Part 2 Products

2.1 SWITCHES

- .1 15A, 120V AC, premium specification grade, single pole, commercial decorator paddle type and complete with the following features:

- .1 Terminal holes approved for #10 AWG wiring.
 - .2 Silver alloy contacts.
 - .3 Urea molding.
 - .4 Suitable for side and back wiring.
 - .5 Fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity for motor loads.
 - .6 Standard of acceptance: Arrow Hart 7601AM White. Other acceptable manufacturers: Pass & Seymour-Legrand, Hubbell, Bryant.
 - .7 Impact Resistant
- .2 Switches of one manufacturer throughout project.
 - .3 Complete with pilot light as indicated. Pilot lights to be illuminated in the "off" position.
 - .4 Acceptable manufacturer: Bryant, Arrow Hart, Pass and Seymour.

2.2 RECEPTACLES

- .1 Duplex receptacles, NEMA No. 5-15 R, 125 VAC, 15 A, parallel slot, U ground, with the following features:
 - .1 Suitable for #10 AWG back and side wiring.
 - .2 Break-off links for use as split receptacles.
 - .3 Double wipe contacts and non-riveted grounding contacts.
 - .4 Aluminum yokes, blades or terminals or with CU/AL rating will not be accepted.
 - .5 Acceptable manufacturer: Arrow Hart #5262, Bryant #5262, Pass and Seymour #5262
- .2 Single receptacles NEMA No. 5-15R, 125V AC, 15A, U-ground, suitable for #10 back and side wiring.
- .3 Other receptacles with ampacity and voltage as required.
- .4 Receptacles of one manufacturer throughout project.
- .5 Colour of receptacles shall be as follows:
 - .1 White for normal power.
- .6 Duplex receptacles, NEMA No. 5-20 R, T slot, 125 VAC, U ground, with the following features:
 - .1 Nylon face.
 - .2 Suitable for #10 AWG back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Double wipe contacts and non-riveted grounding contacts.
 - .5 Aluminum yokes, blades or terminals or with CU/AL rating will not be accepted.
 - .6 Acceptable manufacturers: Bryant #5362, Arrow Hart #5362, Pass & Seymour #5362.
- .7 Duplex receptacles, NEMA No. 6-30 R, 250 VAC, with the following features:
 - .1 Nylon face.
 - .2 Suitable for #8 AWG back and side wiring.
 - .3 Double wipe contacts and non-riveted grounding contacts.

- .4 Aluminum yokes, blades or terminals or with CU/AL rating will not be accepted.
- .8 Standard of acceptance: Pass & Seymour-LeGrand #1801. Other acceptable manufacturers: Bryant, Arrow Hart.

2.3 SPECIAL WIRING DEVICES

- .1 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for weatherproof duplex receptacles.
- .2 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.
- .3 Provide special receptacles as required to suit specific equipment requirements as follows:
 - .1 30 amp, 125/250V, 3-pole, 4-wire receptacle NEMA #14-30R.
 - .2 20 amp, 125V, 2-pole, 3-wire universal receptacle NEMA #5-20RA.
 - .3 50 amp, 250V, 2-pole, 3-wire universal receptacle NEMA #6-50RA.
 - .4 Refer to floor plans for locations.
- .4 Ground fault circuit interrupting receptacle (GFCI), 15A, 125V, nylon face, feed-thru feature, contrasting colour band on reset button, screw terminals, white-coloured face.
Standard of acceptance: Pass & Seymour-LeGrand 1595 White.
Other acceptable manufacturers: Bryant, Arrow Hart.
- .5 Ground fault circuit interrupting receptacle (GFCI), 20A, 125V, nylon face, feed-thru feature, contrasting colour band on reset button, screw terminals, white-coloured face.
Standard of acceptance: Pass & Seymour-LeGrand 2095 White.
Other acceptable manufacturers: Bryant, Arrow Hart.

- .6 Ground fault circuit interrupter receptacle: Class A rated, CSA type 5-15R, 125V, 15A feed through rated to: CSA-C22.2 No. 144 with the following features:
 - .1 Specification grade.
 - .2 Nylon moulded housing.
 - .3 Decora style.
 - .4 Suitable for No. 10 AWG for side and back wiring.
 - .5 Solid state ground sensing device.
 - .6 Testing and reset buttons.
 - .7 Indicator light to show status of GFCI protection operation.
 - .8 Malfunction protection. Device cannot be reset if GFCI is non operational or unit is wired incorrectly.
 - .9 30mA trip level.
- .7 Ground fault circuit interrupter receptacle: Class A rated, CSA type 5-20R, 125V, 20A T-Slot feed through rated to: CSA-C22.2 No. 144 with the following features:
 - .1 Specification grade.
 - .2 Nylon moulded housing.
 - .3 Decora style.
 - .4 Suitable for No. 10 AWG for side and back wiring.
 - .5 Solid state ground sensing device.
 - .6 Testing and reset buttons.
 - .7 Indicator light to show status of GFCI protection operation.
 - .8 Malfunction protection. Device cannot be reset if GFCI is non operational or unit is wired incorrectly.
 - .9 30mA trip level.

2.4 METAL WHILE-IN-USE WEATHER PROTECTIVE COVER BOXES

- .1 DEVICE TO MEET CEC FOR RECEPTACLES IN DAMP OR WET LOCATIONS.**
- .2 DIECAST POWDER COATED ALUMINUM. VERTICAL OR HORIZONTAL AS INDICATED.**
- .3 NEMA 3R RATING**
- .4 COMPLETE WITH GASKET, MOUNTING HARDWARE, DUPLEX RECEPTACLE INSERT AND GFCI RECEPTACLE INSERT**
- .5 LOCKABLE TO PREVENT ACCIDENTAL DISCONNECTS.**

2.5 COVER PLATES

- .1 Provide cover plates for all wiring devices.
- .2 Cover plates from one manufacturer throughout project.
- .3 Coverplates for surface mounted receptacles and switches on exposed conduit systems shall be stainless steel 12mm raised type.
- .4 Stainless steel coverplates, thickness 1mm for wiring devices mounted in flush-mounted outlet box.

- .5 Cast gasketed coverplates for wiring devices mounted in surface-mounted cast Feraloy type conduit boxes.
- .6 Duplex cast aluminum spring-loaded weatherproof coverplates for exterior mounted wiring devices, flush mounted or surface mounted in FS or FD boxes.
- .7 Acceptable manufacturer: Pass and Seymour, Arrow Hart, Bryant.

2.6 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.
- .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.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
 - .4 Install GFI 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 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.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section covers items common to Sections of Divisions 26. This Section supplement requirements of Division 1.

1.2 REFERENCES

- .1 Not used

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 storage cabinet.

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 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.
- .2 Fuses: product of one manufacturer.

2.2 FUSE TYPES

- .1 Class L fuses.
 - .1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .2 Type L2, fast acting.
- .2 Class J fuses.
 - .1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
 - .2 Type J2, fast acting.
- .3 Class R -R fuses.

- .1 Type R1, (UL Class RK1), time delay, capable of carrying 500% of its rated current for 10 s minimum, to meet UL Class RK1 maximum let-through limits.
- .2 Type R2, time delay, capable of carrying 500% of its rated current for 10 s minimum.
- .3 Type R3, (UL Class RK1), fast acting Class R, to meet UL Class RK1 maximum let-through limits.
- .4 Class C fuses.

2.3 FUSE STORAGE CABINET

- .1 Fuse storage cabinet, manufactured from 2.0 mm thick aluminum 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door finished in accordance with Section 26 05 00 - Common Work Results for Electrical.

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.
 - .1 Install rejection clips for Class R fuses.
- .3 Ensure correct fuses fitted to assigned electrical circuit.
- .4 Install spare fuses in fuse storage cabinet.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section covers items common to Sections of Divisions 26. This Section supplement requirements of Division 1.

1.2 REFERENCES

- .1 CSA International
 - .1 CSA C22.2 No. 5-09, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

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 breakers with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.
- .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 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store circuit breakers off ground, indoors, in dry location 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.

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers: 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 10kA symmetrical rms interrupting capacity rating.

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.

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.
 - .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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section covers items common to Sections of Division 26. This Sections supplement requirements of Division 1.

1.2 REFERENCES

- .1 CSA Group
 - .1 CAN/CSA-C22.2 No.4-04(R2009), Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMJ-J-162-2004 and UL 98).
 - .2 CSA C22.2 No.39-13, Fuseholder Assemblies.

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 disconnect switches - fused and non-fused and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect disconnect switches - fused and non-fused from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DISCONNECT SWITCHES

- .1 Non-fusible, Horsepower rated disconnect switch in CSA enclosure, to CAN/CSA-C22.2 No.4 size as indicated.
- .2 Provision for padlocking in on-off switch position by 3 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.
- .8 Mounted inside NEMA 4X enclosure when installed outdoors or within bridge deck.

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.

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 disconnect switches - fused and non-fused 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 disconnect switches complete with fuses if applicable.

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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section covers items common to Sections of Division 26. This Section supplement requirements of Division 1.

1.2 REFERENCES

- .1 CSA International
 - .1 CSA C22.2 No.14-10, Industrial Control Equipment.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA ICS 2-2000 (R2005), Controllers, Contactors and Overload Relays Rated 600 V.

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 contactors 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 contactors for incorporation into manual.
- .3 Include operating information required for start-up, synchronizing and shut-down of generating units.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect contactors from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 CONTACTORS

- .1 Contactors: to CSA C22.2 No.14.

- .2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.
- .3 Breaker combination contactor as indicated.
- .4 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.
- .5 Mount in NEMA 3R Enclosure unless otherwise indicated.
- .6 Include following options in cover:
 - .1 Red and Green indicating lamp.
 - .2 Hand-Off-Auto selector switch.

2.2 EQUIPMENT IDENTIFICATION

- .1 Identify equipment in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Size 4 nameplate indicating as indicated.

Part 3 Execution

3.1 INSTALLATION

- .1 Install contactors and connect power wires and auxiliary control devices.
- .2 Identify contactors with nameplates or labels indicating panel and circuit number.
- .3 Test contactors in accordance with 26 05 00 - Common Work Results for Electrical.

3.2 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.

3.3 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section covers items common to Sections of Division 26. This Section supplement requirements of Division 1.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)
- .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 F1137-00(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: spacing criterion.
- .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, cleaning procedures.
- .4 Submit application for Manitoba Hydro Power Smart Commercial Lighting Rebate along with all lighting shop drawing

1.4 QUALITY ASSURANCE

- .1 Provide mock-ups in accordance with Section 01 45 00 - Quality Control.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 DRIVERS

- .1 LED Drivers
- .2 Reliable and consistent operation
- .3 High efficiency >90%
- .4 Greater than 0.9 PF and Less than 20% THD
- .5 Greater than 50,000 hrs life time
- .6 5-year limited warranty
- .7 ROHS compliance
- .8 Safety approbations (UL, CSA, CE, ENEC, PSE, SELV or CQC)
- .9 Dimmable and Programmable.
- .10 Designed to meet the needs of LED lighting
- .11 Available in either dedicated input voltage or Intellivolt options
- .12 The Adjustable Output Current (AOC) feature
- .13 Specific dimmable versions to enable use of lighting controls to help increase energy saving through a wide variety of protocols, such as 0-10V

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 in luminaire schedule.

2.4 LUMINAIRES

- .1 As indicated in luminaire schedule.

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:
 - .1 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations support luminaires independently of ceiling, support luminaires from ceiling grid in accordance with local inspection requirements.

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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 This Section covers items common to Sections of Division 26. This Section supplement requirements of Division 1.

1.2 REFERENCES

- .1 CSA Group
 - .1 CSA C22.2 No.206-13, Lighting Poles.

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 roadway lighting and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Pole shop drawings to be sealed by a professional structural engineer registered in the Province of Manitoba.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect roadway lighting from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 ALUMINUM POLES

- .1 Aluminum poles: to CSA C22.2 No.206 designed for underground wiring and:
 - .1 Mounting on concrete anchor base and bridge structure.
 - .2 Style: monotube, round tapered 6063-T4 aluminum, wall thickness 4.5 mm.
 - .3 Straight for 1 and 2 luminaire mounting brackets.
 - .4 Access handhole 762 mm above pole base for wiring connections, with welded-on reinforcing frames bolted-on cover.
 - .5 Finish: semi-lustrous satin by rotary sand process.
 - .6 Grounding lug.
 - .7 Refer to drawings for pole types.

2.2 LUMINAIRE MOUNTING BRACKETS

- .1 Mounting brackets for roadway lighting poles to be galvanized steel for specified luminaires:
 - .1 Single and twin brackets as indicated.
 - .2 Arm extension length: 1.8m.
 - .3 Type: Elliptical arm with curved tenon.
- .2 Mounting brackets for canal lighting poles are to be aluminum for specified luminaires:
 - .1 Twin and Triple bracket.
 - .2 Arm extension length: 508mm with 381mm upright
 - .3 Type: Bullhorn arms

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 roadway 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 poles true and plumb, complete with brackets in accordance with manufacturer's instructions.
- .2 Install luminaires on pole.
- .3 Check luminaire orientation, level and tilt.
- .4 Connect luminaire to lighting circuit.
- .5 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

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.

END OF SECTION