Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-09, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.

.2 CAN/CSA-C22.3 No. 1-01(Update March 2005), Overhead Systems.

.3 CAN3-C235-83(R2000), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.3 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.

1.2 DEFINITIONS

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

1.3 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates for control items in English and French.

.4 Use one nameplate for both languages.

1.4 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS in accordance with Section 01 47 15 - Sustainable Requirements: Construction and Section 02 81 01 - Hazardous Materials.

.3 Submit for information, single line electrical diagrams under plexiglass and locate in main electrical distribution room.

.1 Electrical distribution system in main electrical room.

.4 Submit for information, fire alarm riser diagram, plan and zoning of building under plexiglass at fire alarm control panel and annunciator.

.5 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer.

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

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

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

.5 If changes are required, notify Engineer of these changes before they are made.

.6 Quality Control: in accordance with Section 01 45 00 - Quality Control.

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for approval before delivery to site. Pay all applicable fees for certification.

.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 Engineer.

.7 Manufacturer's Field Reports: submit to Engineer the 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.

.8 **Record Drawings**: a complete set of red-line drawings must be provided at the end of the project identifying the actual installation location of all installed components.

.1 Keep a set of drawings on site with all mark-ups updated on a daily basis. Once a change to the plans have been made, they should be marked on the drawings immediately to minimize errors (do not rely on memory).

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "RECORD DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Transfer information daily to master reproducibles, revising reproducibles to show work as actually installed.

.4 Use different colour waterproof ink for each system.

.5 Any changes to specified products (approved request for equals or alternates) must be identified on the drawings.

.6 Make available for reference purposes and inspection.

.7 Drawings that do not reflect the installation with reasonable accuracy (at the discretion of the engineer) will be subject to a **hold-back** of $800 per drawing.

.8 Submit reproducible record drawings with copies of O&M manuals.

1.5 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.

.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

.3 Site Meetings:

.1 In accordance with Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM).

.2 Site Meetings: as part of Manufacturer's Field Services described in Part 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.

.1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of Work, after cleaning is carried out.

.4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide the Project Manager with schedule within 2 weeks after award of Contract.

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

1.7 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 will aspects of its care and operation.

1.8 OPERATING INSTRUCTIONS

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

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

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

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

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

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

.2 Do verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

2.2 MATERIALS AND EQUIPMENT

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

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

.3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of Department of Labour.

.2 Decal signs, minimum size 175 x 250 mm.

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 as follows:

.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, black face (red for emergency equipment), 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 to be approved by Engineer prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate.

.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 building manager.

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

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

2.7 WIRING IDENTIFICATION

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

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

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

2.8 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 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

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 outdoor electrical equipment "equipment green" finish.

.2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

Part 3 Execution

3.1 INSTALLATION

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

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

3.2 NAMEPLATES AND LABELS

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

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.4 LOCATION OF OUTLETS

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

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

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors.

3.5 MOUNTING HEIGHTS

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

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

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

- .1 Local switches: 1400 mm.
- .2 Wall receptacles:
  - .1 General: 300 mm.
  - .2 Above top of continuous baseboard heater: 200 mm.
  - .3 Above top of counters or counter splash backs: 175 mm.
  - .4 In mechanical rooms: 1400 mm or 200 mm below panels.
- .3 Panelboards: as required by Code or as indicated.
- .4 Telephone and interphone outlets: 300 mm.
- .5 Wall mounted telephone and interphone outlets: 1500 mm.
- .6 Fire alarm stations: 1500 mm.
- .7 Fire alarm bells: 2100 mm.
- .8 Television outlets: 300 mm.
- .9 Wall mounted speakers (in offices or halls): 2100 mm.
- .10 Clocks: 2100 mm.
- .11 Door bell pushbuttons: 1500 mm.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.7 FIELD QUALITY CONTROL

.1 Load Balance:

- .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

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

.3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.

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

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

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

.5 Systems: fire alarm system communications.

.6 Insulation resistance testing:

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

.2 Check resistance to ground before energizing.

.3 Carry out tests in presence of Engineer.

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

.5 Manufacturer's Field Services:

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

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

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

3.8 CLEANING

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 RELATED SECTIONS

.1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2No.18-98, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2No.65-93(R1999), Wire Connectors.

.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)

1.4 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused wiring materials from landfill to metal recycling facility as approved by Engineer.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 NEMA to consist of:

.1 Connector body and stud clamp for stranded copper conductors.

.2 Clamp for stranded copper conductors.

.3 Clamp for stranded aluminum conductors.

.4 Stud clamp bolts.

.5 Bolts for copper conductors.

.6 Bolts for aluminum bar.

.7 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 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 CSA C22.2No.65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

.4 Install bushing stud connectors in accordance with EEMAC 1Y-2 NEMA.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

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

1.2 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 BUILDING WIRES

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

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

.3 Neutral supported cable: 2 phase insulated conductors of Copper and one neutral conductor of Copper steel reinforced, size as indicated. Type: NS90 Insulation: Type NSF-2 flame retardant rated 600 V.

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Conductors:

- .1 Grounding conductor: copper.
- .2 Circuit conductors: copper, size as indicated.

.3 Insulation:

- .1 Cross-linked polyethylene XLPE.
- .2 Rating: , 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride.

.7 Fastenings:

- .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
- .2 Channel type supports for two or more cables at 100mm centers.
- .3 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:

.1 Watertight, approved for TECK cable.

2.3 ARMOURED CABLES

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

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Type: ACWU90 flame retardant jacket over thermoplastic armour and compliant to applicable Building Code classification for this project.

.5 Connectors: anti-short connectors.

2.4 ALUMINUM SHEATHED CABLE

.1 Conductors: copper, size as indicated.

.2 Insulation: cross linked polyethylene rated 600 V.

.3 Sheath: aluminum applied to form continuous corrugated sheath.

.4 Outer jacket: none

.5 Fastenings for aluminum sheathed cable:

.1 One hole aluminum straps to secure surface cables 25 mm and smaller. Two hole steel straps for cables larger than 25 mm. Use aluminum strap only with single conductor cable.

.2 Channel type supports for two or more cables at 100mm centers.

.3 Threaded rods: 6 mm diameter to support suspended channels.

2.5 CONTROL CABLES

.1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: thermoplastic.

.2 Sheath : cotton braid thermoplastic jacket, and armour of closely wound aluminum wire.

.2 Type: low energy 300 V control cable: solid annealed copper conductors sized as indicated LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: PVC.

.2 Shielding: wire braid over conductors.

.3 Overall covering: PVC jackets.

2.6 NON-METALLIC SHEATHED CABLE

.1 Non-metallic sheathed copper cable type: NMD90XLPE, size as indicated.

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 before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

.1 Install cable in trenches in accordance with Section 33 71 73.02 - Underground Electrical Service.

.2 Lay cable in cable trays in accordance with Section 26 05 36 - Cable Trays for Electrical Systems.

.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 walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.8 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.9 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

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.

.2 In underground ducts in accordance with Section 33.

.3 In underfloor distribution system in accordance with Section 21.

.4 In surface and lighting fixture raceways in accordance with Section 26.

.5 In wireways and auxiliary gutters in accordance with Section 21.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable concealed, securely supported by hangers.

3.5 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

3.6 INSTALLATION OF ALUMINUM SHEATHED CABLE

.1 Group cables wherever possible on channels.

3.7 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit or underground ducts.

.2 Ground control cable shield.

3.8 INSTALLATION OF NON-METALLIC SHEATHED CABLE

.1 Install cables.

.2 Install straps and box connectors to cables as required.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for connectors and terminations.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.3 Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.41-M1987(R1999), Grounding and Bonding Equipment.

1.4 PRODUCT DATA

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

1.5 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Copper long barrel compression connectors to CSA C22.2No.65-93 as required sized for conductors.

.2 Contact aid for aluminum cables where applicable.

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

.4 4 way junction boxes with respective pothead for 3 conductor cables for enclosing stress - cone within for X - linked polyethylene cable without copper sheath, and overall jacket in accordance with Section 26 05 33 - Raceway and Boxes for Electrical Systems.

Part 3 Execution

3.1 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.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE 837-02, Qualifying Permanent Connections Used in Substation Grounding.

1.2 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 Quality assurance submittals: provide in accordance with Section 01 45 00 - Quality Control.

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

1.3 DELIVERY, STORAGE AND HANDLING

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

.2 Waste Management and Disposal:

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

Part 2 Products

2.1 MATERIALS

.1 Rod electrodes: copper clad steel, 19 mm diameter by 3 m long.

.2 Conductors: bare, stranded, untinned soft annealed copper wire, size No. 4/0 AWG and 2/0 AWG for ground bus, electrode interconnections, metal structures, gradient control mats, transformers, switchgear, motors, ground connections.

.3 Conductors: bare, pvc insulated coloured green, stranded untinned soft annealed copper wire, size No. 3 AWG for grounding cable sheaths, raceways, pipe work, screen guards, switchboards.

.4 Conductors: pvc insulated coloured green, stranded untinned soft annealed copper wire No. 10 AWG for grounding meter and relay cases.

.5 Bolted removable test links.

.6 Accessories: non-corroding, necessary for complete grounding system, type, size material as indicated, including:

.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.

.7 Wire connectors and terminations: as indicated.

.8 Cable sheath isolating sleeves.

Part 3 Execution

3.1 INSTALLATION

.1 Install continuous grounding system including, electrodes, conductors, connectors and accessories as indicated and to requirements of local authority having jurisdiction.

.2 Install connectors and cadweld in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors during and after construction.

.4 Make buried connections, and connections to electrodes, structural steel work, using permanent mechanical connectors to ANSI/IEEE 837.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Use No. 3/0 AWG bare copper cable for main ground bus of substation and No. 2/0 AWG mhd bare copper cable for taps on risers from main ground bus to equipment.

.7 Use tinned copper conductors for aluminum structures.

.8 Do not use bare copper conductors near un-jacketed lead sheath cables.

3.2 ELECTRODE INSTALLATION

.1 Install ground rod electrodes. Make grounding connections to station equipment.

.2 Install ground rod electrodes at switchgear locations.

.3 **Make special provision** for installing electrodes that will give acceptable resistance to ground value, where rock or sand terrain prevails.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections as indicated to typical station equipment including: metallic water main, line sky wire, neutral, gradient control mats. Non current carrying parts of: motors, circuit breakers, reclosers, frames of gang-operated switches and fuse cutout bases. Cable sheaths, raceways, pipe work, switchboards. Meter and relay cases. Any exposed building metal. Outdoor lighting.

.2 Ground hinged doors to main frame of electrical equipment enclosure with flexible jumper.

.3 Connect metallic piping (water, oil, air, etc.) inside to main ground bus at several locations.

3.4 NEUTRAL GROUNDING

.1 Connect distribution neutral using 1000 V insulated conductor to one side of ground test link. Ensure distribution neutral

.2 Interconnect electrodes and neutrals at each grounding installation.

3.5 POLE MOUNTED SWITCHING DEVICE GROUNDING

.1 Drive four ground rods 3 m long at base of each pole on which group-operated line switching devices are mounted.

.2 Arrange rods in square formation with 3 m sides, located so that operator must stand within square to operate switch.

.3 Interconnect ground rods with No. 2/0 AWG stranded annealed copper conductor and join to switch operating handle ground wires.

.4 Connect operating handle of switch to handle base with No. 3/0 AWG extra flexible copper conductor.

3.6 CABLE SHEATH GROUNDING

.1 Bond single conductor, metallic sheathed cables together at one end only. Break sheath continuity by inserting insulating sleeves in cables.

.2 Use No. 6 AWG flexible copper wire soldered, not clamped, to cable sheath.

.3 Connect bonded cables to ground with No. 2/0 AWG copper conductor.

3.7 FIELD QUALITY CONTROL

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

.2 Engage an independent testing agent to inspect grounding and perform ground resistance test before backfill.

.3 Perform earth loop test and resistance tests using method appropriate to site conditions and to approval of local authority having jurisdiction.

.4 Perform test before energizing electrical system.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.2 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE 837-1989(R1996), Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association, (CSA International)

.3 CAN/CSA Z32-1999, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Engineer.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as indicated.

.3 Rod electrodes: copper clad steel 19 mm dia by 3 m long.

.4 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.

.5 Insulated grounding conductors: green, type MC.

.6 Ground bus: copper, size as indicated, 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 Bonding jumpers, straps.
.5 Pressure wire connectors.

Part 3 Execution

3.1 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 flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.9 Install separate ground conductor to outdoor lighting standards.

.10 Connect building structural steel and metal siding to ground by welding copper to steel.

.11 Make grounding connections in radial configuration only, with connections terminating at street side of water pipe. Avoid loop connections.

.12 Bond single conductor, metallic armoured cables to cabinet at supply end, and load end.

.13 Ground secondary service pedestals.

3.2 ELECTRODES

.1 Make ground connections to continuously conductive underground water pipe on street side of water meter.

.2 Install water meter shunt.

.3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.

.4 Install rod electrodes and make grounding connections.

.5 Bond separate, multiple electrodes together.

.6 Use size 4/0 AWG copper conductors for connections to electrodes.

.7 **Make special provision** for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.3 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of primary 600V system, secondary 240/120V or 208/120V system.

3.4 EQUIPMENT GROUNDING

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

3.5 GROUNDING BUS

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

.2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size 2/0AWG.

3.6 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:

.1 Telephones: make telephone grounding system in accordance with telephone company's requirements.

.2 Sound, fire alarm, intercommunication systems as indicated.

3.7 FIELD QUALITY CONTROL

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

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Engineer and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

1.2 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Engineer.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted and suspended.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to hollow masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels at 100 mm on centre spacing.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 91 13 – General Commissioning (Cx) Requirements.

.3 Section 26 05 00 – Common Work Results – Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-09, Canadian Electrical Code, Part 1, 20th Edition.

1.3 SUBMITTALS

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

.2 Product Data:

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

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

.1 Provide drawings stamped and signed by professional engineer.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

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

Part 2 Products

2.1 SPLITTERS

.1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

2.2 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 flat covers.

2.3 CABINETS

.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

.2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm fir plywood backboard for surface flush mounting.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Mount plumb, true and square to building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.

.2 Identification Labels: size 2 indicating system name voltage and circuit or as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-06, Canadian Electrical Code, Part 1, 20th Edition.

1.2 SUBMITTALS

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

.2 Submit samples for floor box in accordance with Section 01 33 00 - Submittal Procedures.

1.3 DELIVERY, STORAGE AND HANDLING

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

.2 Waste Management and Disposal:

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

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

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

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 MASONRY BOXES

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

2.4 CONCRETE BOXES

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

2.5 FLOOR BOXES

.1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brass faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 73 mm for receptacles and communication outlets.

.2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 16, 21 and 27 mm conduit. Minimum size: 73 mm deep.

2.6 CONDUIT BOXES

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

2.7 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.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.

2.8 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

2.9 SERVICE FITTINGS

.1 'High tension' receptacle fitting made of 2 piece die-cast aluminum with brushed aluminum housing finish for 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, mineral insulated and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 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).

1.2 SUBMITTALS

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

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.

.1 Submit cable manufacturing data.

.3 Quality assurance submittals:

.1 Test reports: submit certified test reports.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

.2 Place materials defined as hazardous or toxic waste in designated containers.

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

Part 2 Products

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.

.1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

.3 Identify cables for exclusively dc applications.

2.2 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel or aluminum threaded.

.2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.3 Rigid pvc conduit: to CSA C22.2 No. 211.2.

.4 Flexible metal conduit: to CSA C22.2 No. 56, aluminum.

.5 Flexible pvc conduit: to CAN/CSA-C22.2 No. 227.3.

2.3 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits NPS 2 50 mm and smaller.

.1 Two hole steel straps for conduits larger than NPS 2 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 2.5 m 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 NPS 1 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 100 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 unfinished areas.

.3 Surface mount conduits except where room finishes allow for concealment.

.4 Use rigid galvanized steel or aluminum threaded conduit except where specified otherwise.

.5 Use electrical metallic tubing (EMT) except in cast concrete.

.6 Use rigid pvc conduit underground.

.7 Use flexible metal conduit for connection to motors in dry areas connection to recessed incandescent fixtures without prewired outlet box connection to surface or recessed fluorescent fixtures.

.8 Minimum conduit size for lighting and power circuits: NPS 3/4 19 mm.

.9 Install EMT conduit from branch circuit panel to outlet boxes located in sub floor.

.10 Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.11 Mechanically bend steel conduit over 19 mm diameter.

.12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.13 Install fish cord in empty conduits.

.14 Run 2-NPS 1 25 mm spare conduits up to ceiling space and 2-NPS 1 25 mm spare conduits down to ceiling space from each flush panel.

.1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

.15 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.16 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Run conduits in flanged portion of structural steel.

.3 Group conduits wherever possible on suspended and surface channels.

.4 Do not pass conduits through structural members except as indicated.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel.

.1 Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.

.1 Use cold mastic between sleeve and conduit.

.5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.6 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Run conduits NPS 1 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.

3.7 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.8 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.3 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association, (CSA International)

.2 Insulated Cable Engineers Association, Inc. (ICEA)

1.3 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.5 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Project Manager.

.6 Do not dispose of preservative treated wood through incineration.

.7 Do not dispose of preservative treated wood with other materials destined for recycling or reuse.

.8 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Project Manager.

.9 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 CABLE PROTECTION

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

2.2 MARKERS

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

.2 Cedar post type markers: 89 x 89 mm, 1.5 m long, pressure treated with copper napthenate or 5% pentachlorophenol solution, water repellent preservative, with nameplate fastened near post top, on side facing cable or conduit to indicate depth and direction of duct and cable runs.

.1 Nameplate: aluminum anodized 89 x 125 mm, 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words Cable, Joint or Conduit with arrows to indicate change in direction.

Part 3 Execution

3.1 DIRECT BURIAL OF CABLES

.1 After sand bed specified in Section 31 23 33.01 - Excavating, Trenching and Backfilling, is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.

.2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.3 Underground cable splices not acceptable.

.4 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

.5 Cable separation:

.1 Maintain 75 mm minimum separation between cables of different circuits.

.2 Maintain 300 mm horizontal separation between low and high voltage cables.

.3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.

.4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.

.5 Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.

.6 Install treated planks on lower cables 0.6 m in each direction at crossings.

.6 After sand protective cover specified in Section 31 23 33.01 - Excavating, Trenching and Backfilling, is in place, install continuous row of overlapping 38 x 140 mm pressure treated planks to cover length of run.

3.2 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.1 Do not pull spliced cables inside ducts.

.2 Install multiple cables in duct simultaneously.

.3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.6 After installation of cables, seal duct ends with duct sealing compound.

3.3 MARKERS

.1 Mark cable every 150 m along cable duct runs and changes in direction.

.2 Mark underground splices.

.3 Where markers are removed to permit installation of additional cables, reinstall existing markers.

.4 Install cedar post type markers.

.5 Lay concrete markers flat and centred over cable with top flush with finish grade.

3.4 FIELD QUALITY CONTROL

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

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance tests.

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test.

.3 High Potential (Hipot) Testing.

.1 Conduct hipot testing at 100% of original factory test voltage in accordance with manufacturer's recommendations.

.4 Leakage Current Testing.

.1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.

.2 Hold maximum voltage for time period specified by manufacturer .

.3 Record leakage current at each step.

.7 Provide Engineer with list of test results showing location at which each test was made, circuit tested and result of each test.

.8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 100-04, Motors and Generators.

.2 CSA C22.2 No. 145-M1986(R2004), Motors and Generators for Use in Hazardous Locations.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC M1-7-1992, Standard for Motors and Generators.

1.2 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

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

.3 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer.

.2 Indicate dimensions, recommended installation procedure, wiring diagrams, sizes and location of mounting bolt holes and recommended support method.

.4 Quality Assurance Submittals:

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Manufacturer's Instructions: submit manufacturer's installation instructions.

.5 Closeout Submittals:

.1 Provide maintenance data for fractional horsepower motors for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

.2 Collect, package and store expired motors for either recycling or rebuilding and return to recycler or rebuilder.

Part 2 Products

2.1 FRACTIONAL HORSEPOWER MOTOR

.1 Non-hazardous locations: to CSA C22.2 No. 100 and EEMAC M1-7.

.2 Motor with inherent overheating protectors.

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 wiring, flexible connections and grounding.

.2 Check rotation before coupling to driven equipment.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.3 Section 02 81 01 - Hazardous Materials.

.4 Section 26 05 00 - Common Work Results - Electrical.

.5 Section 26 50 00 - Lighting.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No.184.1-96, Solid-State Dimming Controls (Bi-national standard with UL 1472).

1.3 PRODUCT DATA

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

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 81 01 - Hazardous Materials. WHMIS acceptable to Labour Canada, and Health and Welfare Canada.

.3 Submit product data sheets for fluorescent lighting control equipment. Include product characteristics, performance criteria, physical size, limitations and finish.

.4 Manufacturer’s Instructions: Provide to indicate special handling criteria, installation sequence, and cleaning procedures and.

1.4 SHOP DRAWINGS

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

.2 Indicate shielded wiring requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

.2 Place materials defined as hazardous or toxic waste in designated containers.

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

.4 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 EQUIPMENT - GENERAL

.1 Dimming system: to CSA C22.2 No.184.1, packaged in accordance with the Canadian Code for Preferred Packaging guidelines, components to be from one manufacturer, and to comprise an integrated system.

.2 System to start, and operate continuously, within intensity setting of 20 to 100%.

.3 System to include approved radio, VCR and TV interference suppressors.

.4 System voltage as indicated.

2.2 INTENSITY SELECTOR

.1 Intensity selector unit, containing solid state firing circuit, master potentiometer, manually operated providing for continuous adjustment from maximum intensity, to 20 % of maximum intensity, and actuating up to 100 multiple dimming auxiliaries, suitable for installation in three gang wall box and complete with knob and faceplate.

2.3 ON-OFF SWITCH

.1 On-off switch mounted in same wall box as intensity selector.

2.4 DIMMING AUXILIARIES

.1 Dimming auxiliaries, to control 4 multiple dimming ballasts, suitable for mounting in lighting fixture.

2.5 BALLASTS

.1 To Section 26 50 00 - Lighting.

2.6 RELAYS, CONTACTORS

.1 Enclosed solid-state relays, contactors and controls for multipoint control.

Part 3 Execution

3.1 INSTALLATION

.1 Install components comprising dimming system in accordance with manufacturer's instructions, and as indicated.

.2 Install wiring, shielding, grounding in accordance with manufacturer's instructions.

.3 Ensure shielded leads between intensity selector potentiometer and intensity controls have outer insulating jackets and are connected to ground at one point only.

.4 Keep radio, VCR, TV and intercom wiring a minimum of 1.8 m away from dimming circuitry. Where crossing of wiring is essential, ensure that grounded shields surround such intercom wiring, and that crossings take place at 90E.

.5 Locate intensity controls and "on-off" switches as indicated.

.6 Ensure positive, low resistance lamp to pin contact within lampholder.

.7 Condition lamps by operating at full intensity for 100 h prior to final inspection. Operate ballasts in ambient temperature above 18EC.

.8 Ensure connections are correctly made and to same phase before energizing.

3.2 FIELD QUALITY CONTROL

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

.2 Demonstrate that dimming systems are installed as indicated.

.3 Demonstrate that dimming systems operate as intended and that there are no problems in starting lamps, nor in keeping them lit, and free of perceptible flicker at any setting of dimming intensity control.

.4 Demonstrate that no radio, VCR or TV interference is carried by system and that there is no interference between dimming system and locally used infrared-based remote/integral controls.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for low voltage switchgear for controlling relatively large loads - 2000 A or larger.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.3 Section 01 78 00 - Closeout Submittals.

.4 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.31-M89(R2000), Switchgear Assemblies.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC G8-3.3, Metal-Enclosed Interrupter Switchgear Assemblies.

1.4 SHOP DRAWINGS PRODUCT DATA

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

.2 Indicate on shop drawings:

.1 Floor anchoring method and foundation template.
.2 Dimensioned cable entry and exit locations.
.3 Dimensioned position and size of bus.
.4 Overall length, height and depth of complete switchgear.
.5 Dimensioned layout of internal and front panel mounted components.

.3 Indicate on product data:

.1 Time-current characteristic curves for air circuit breakers.

1.5 QUALITY ASSURANCE

.1 Submit 3 copies of certified factory test results.

1.6 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for secondary switchgear for incorporation into manual in accordance with Section 01 78 00 - Closeout Submittals.

.2 3 copies maintenance data for complete switchgear assembly including components.

1.7 STORAGE AND PROTECTION

.1 Store switchgear on site in protected, dry location. Cover with plastic to keep off dust.

.2 Provide energized strip heater in each cell to maintain dry condition during storage.

1.8 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Project Manager.

.5 Fold up metal banding, flatten and place in designated area for recycling.

1.9 EXTRA MATERIALS

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

Part 2 Products

2.1 MATERIALS

.1 Switchgear assembly: to EEMAC G8-3.3 CAN/CSA-C22.2No.31.

2.2 RATING

.1 Secondary switchgear: indoor, 120/208 V, 1200 A, 3 phase, 4 wire, 60 Hz, minimum short circuit capacity 200 kA (rms symmetrical).

2.3 ENCLOSURE

.1 Main incoming section to contain:

.1 Air circuit breaker Moulded case circuit breaker sized as indicated.

.2 Ammeter and selector switch.

.3 Voltmeter and selector switch.

.4 Demand meter.

.5 Provision for electrical power supply authority metering.

.2 Distribution sections to contain:

.1 Moulded case circuit breaker sized as indicated.

.2 Aluminum bus, from main section to distribution sections including vertical bussing.

.3 Blanked off spaces for future units.

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

.5 Access from front.

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

.7 Interior lighting: 100 W lamp in porcelain lampholder in each cubicle with externally mounted switch and pilot light.

.8 Receptacle: 120 V, single phase, 60 Hz, duplex, U-ground, in each cubicle.

2.4 BUSBARS

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

.2 Busbars and main connections: 99.30% conductivity aluminum.

.3 Provision for extension of bus on both sides of unit without need for further drilling or preparation in field.

.4 Tin plated joints, secured with non-corrosive bolts and Belleville washers.

.5 Identify phases of busbars by suitable marking.

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

2.5 GROUNDING

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

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

2.6 MOULDED CASE CIRCUIT BREAKERS

.1 Main breaker: ABB Isomax S7.

2.7 POWER SUPPLY AUTHORITY METERING

.1 Separate compartment and metal raceway for exclusive use of power supply authority metering.

.2 Mounting accessories and wiring for metering supplied by power supply authority:

.1 Watthour meter.

2.8 FINISHES

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

.1 Cubicle exteriors gray.

.2 Cubicle interiors gray.

2.9 EQUIPMENT IDENTIFICATION

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

.2 Nameplates:

.1 White plate, black letters, size7.

.2 Complete switchgear labelled: "120/208 V" (as applicable).

.3 Main cubicle labelled: "Main Breaker".

.4 Distribution units labelled: "Feeder No.1 ", "Feeder No.2 ".

Part 3 Execution

3.1 INSTALLATION

.1 Locate switchgear assembly as indicated and bolt to base channels.

.2 Connect main secondary power supply to main breaker bus.

.3 Connect load side of breakers in distribution cubicles to distribution feeders.

.4 Check factory made connections for mechanical security and electrical continuity.

.5 Run one grounding conductor 3/0AWG bare copper in 25 mm conduit from ground bus to ground.

.6 Check trip unit settings against co-ordination study to ensure proper working and protection of components.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Service equipment and installation.

1.2 RELATED SECTIONS

.1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.2 Section 26 05 28 - Grounding - Secondary.

.3 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

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

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

.6 Section 26 24 16.01 - Panelboards Breaker Type.

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

1.3 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Project Manager.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 EQUIPMENT

.1 Fused disconnect switch: in accordance with Section 26 28 23 - Disconnect Switches - Fused and Non-Fused , rating as indicated.

.2 Enclosed circuit breaker: in accordance with Section 26 28 16.02 - Moulded Case Circuit Breakers, rating as indicated.

.3 Panelboard breaker type: in accordance with Section 26 24 16.01 - Panelboards Breaker Type, rating as indicated.

.4 Cabinet type 'A' for utility revenue metering Junction box Pull box Splitter box: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.5 Ground fault equipment: in accordance with Section 26 28 20 - Ground Fault Circuit Interrupters - Class "A".

Part 3 Execution

3.1 INSTALLATION

.1 Install service equipment.

.2 Connect to incoming service.

.3 Connect to outgoing load circuits.

.4 Install ground fault equipment.

.5 Make grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.

.6 Make provision for power supply authority's metering.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for service entrance board.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.3 Section 01 78 00 - Closeout Submittals.

.4 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 CAN/CSA-C22.2 No.31-M89(R2000), Switchgear Assemblies.

1.4 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Indicate on shop drawings.

- .1 Floor anchoring method and foundation template.
- .2 Dimensioned cable entry and exit locations.
- .3 Dimensioned position and size of bus.
- .4 Overall length, height and depth.
- .5 Dimensioned layout of internal and front panel mounted components.

.3 Include time-current characteristic curves for circuit breakers and fuses.

1.5 QUALITY ASSURANCE

.1 Submit 3 copies of certified test results.

1.6 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for service entrance board for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Submit 3 copies maintenance data for complete assembly including components.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Project Manager.

1.8 EXTRA MATERIALS

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

Part 2 Products

2.1 SERVICE ENTRANCE BOARD

.1 Service Entrance Board: to CAN/CSA-C22.2 No.31.

.2 Rating: 347/600 V, 3 phase, 4 wire, 1200 A, short circuit current 200 kA (rms symmetrical).

.3 Cubicles: free standing, dead front, size as indicated.

.4 Barrier metering section from adjoining sections.

.5 Provision for installation of power supply authority metering in barriered section.

.6 Owners metering.

.7 Distribution section.

.8 Hinged access panels with captive knurled thumb screws.

.9 Bus bars and main connections: aluminum.

.10 Bus from load terminals of main breaker to main lugs of distribution section.

.11 Cable from load terminals of main breaker to metering section and cable from metering section to lugs of distribution section.

.12 Identify phases with colour coding.

2.2 MOULDED CASE CIRCUIT BREAKERS

.1 ABB S7, Cutler Hammer.

2.3 GROUNDING

.1 Copper ground bus extending full width of cubicles and located at bottom.

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

2.4 POWER SUPPLY AUTHORITY METERING

.1 Mounting accessories and wiring for metering supplied by power supply authority:

.1 Watthour meter.

2.5 FINISHES

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

.1 Service entrance board exterior: gray.

2.6 EQUIPMENT IDENTIFICATION

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

.2 Nameplates:

.1 White plate, black letters, size7.
.2 Complete board labelled: "347/600 V."
.3 Main disconnect labelled: "Main Breaker ".
.4 Branch disconnects labelled: "Feeder Panel __", as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Connect main secondary service to line terminals of main breaker.

.2 Connect load terminals of distribution breaker's to feeders.

.3 Check factory made connections for mechanical security and electrical continuity.

.4 Run one grounding conductor 3/0 AWG bare copper in 1" 25 mm conduit from ground bus to building ground.

.5 Check trip unit settings against co-ordination study to ensure proper working and protection of components.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.3 Section 06 10 00.01 - Rough Carpentry - Short Form: Plywood Backboard.

.4 Section 26 05 00 - Common Work Results - Electrical.

.5 Section 26 28 21 - Moulded Case Circuit Breakers.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2No.29-M1989(R2000), Panelboards and enclosed Panelboards.

1.4 SHOP DRAWINGS

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

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Project Manger.

Part 2 Products

2.1 PANELBOARDS

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

.1 Install circuit breakers in panelboards before shipment.

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

.2 250 and 600 V panelboards: bus and breakers rated for 10kA and 18kA (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 Two keys for each panelboard and key panelboards alike.

.6 Aluminum bus with neutral of same ampere rating as mains.

.7 Mains: suitable for bolt-on breakers.

.8 Trim with concealed front bolts and hinges.

.9 Trim and door finish: baked grey enamel.

2.2 CUSTOM BUILT PANELBOARD ASSEMBLIES

.1 125 mm relay section on one or both sides of panels as indicated for installation of low voltage remote control switching components.

.2 Double stack panels as indicated.

.3 Contactors in mains as indicated.

.4 Feed through lugs as indicated.

.5 Isolated ground bus.

2.3 BREAKERS

.1 Breakers: to Section 26 28 21 - 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 designated building maintenance personnel.

.5 Lock-on devices for receptacles, fire alarm clock outlet, emergency, door supervisory, intercom, stairway, exit and night light circuits.

2.4 EQUIPMENT IDENTIFICATION

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

Part 3 Execution

3.1 INSTALLATION

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

.2 Install surface mounted panelboards 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 – Electrical or as indicated.

.4 Connect loads to circuits.

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

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power Distribution Panelboard - Furnish and install distribution panelboard(s) as specified herein and where shown on the associated schedules, drawings.

1.02 REFERENCES

The panelboard(s) and circuit breaker(s) referenced herein are designed and manufactured according to the latest revision of the following specifications.

A. NEMA PB 1 - Panelboards

B. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

C. NEMA AB 1 - Molded Case Circuit Breakers

D. UL 50 - Enclosures for Electrical Equipment

E. UL 67 - Panelboards

F. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures

G. CSA Standard C22.2 No. 29-M1989 - Panelboards and Enclosed Panelboards

H. CSA Standard C22.2 No. 5-M91 - Molded Case Circuit Breakers

I. Federal Specification W-P-115C - Type I Class 1

J. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit And Service.

K. Federal Specification W-C-865C - Fusible Switches

L. NFPA 70 - National Electrical Code (NEC)

M. ASTM - American Society of Testing Materials

1.03 SUBMITTAL AND RECORD DOCUMENTATION

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

1.04 QUALIFICATIONS

A. Company specializing in manufacturing of panelboard products with a minimum of fifty (50) years documented experience.

B. Panelboards shall be manufactured in accordance with standards listed Article 1.02 - REFERENCES.

1.05 DELIVERY, STORAGE, AND HANDLING

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

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

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

1.06 OPERATIONS AND MAINTENANCE MATERIALS

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

1.07 WARRANTY

A. Manufacturer shall warrant specified equipment free from defects in materials and workmanship for the lesser of one (1) year from the date of installation or eighteen (18) months from the date of purchase.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Shall be Square D Company I-LINE – Class 2110

B. Substitutions must be submitted in writing three weeks prior to original bid date with supporting documentation demonstrating that the alternate manufacturer meets all aspects of the specification herein.

2.02 POWER DISTRIBUTION PANELBOARDS

A. I-LINE Circuit Breaker Distribution Panelboard

1. Interior

a. Shall be Square D I-LINE type rated 600 Vac maximum. Continuous main current ratings as indicated on associated [schedules] [drawings] not to exceed 1200 amperes maximum. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67.

b. Provide UL Listed short circuit current ratings (SCCR) as indicated on the associated schedules, drawings not to exceed the lowest interrupting capacity rating of any circuit breaker installed with a maximum of 200,000 RMS symmetrical amperes. Main lug and main breaker panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230.VI and VII.

c. The panelboard interior shall have three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus.

d. The bussing shall be fully rated with sequentially phased branch distribution. Panelboard bussing rated 100 through 600 amperes shall be plated [aluminum]. Bussing rated 800 amperes and above shall be plated copper. Bus bar plating shall run the entire length of the bus bar. The entire interleaved assembly shall be contained between two (2) U-shaped steel channels, permanently secured to a galvanized steel-mounting pan by fasteners.

e. Interior trim shall be of dead-front construction to shield user from all energized parts. Main circuit breakers through 800 amperes shall be vertically mounted. Main circuit breaker and main lug interiors shall be field convertible for top or bottom incoming feed.

f. A solidly bonded aluminum equipment ground bar shall be provided. An additional aluminum isolated/insulated ground bar shall also be provided.

g. Solid neutral shall be equipped with a full capacity bonding strap for service entrance applications. Gutter-mounted neutral will not be acceptable.

h. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label, and Short Circuit Current Rating shall be displayed on the interior or in a booklet format. Leveling provisions shall be provided for flush mounted applications.

2. Group mounted circuit breakers through 1200A

   a. Circuit breaker(s) shall be group mounted plug-on with mechanical restraint on a common pan or rail assembly.

   b. The interior shall have three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus.

   c. Circuit breakers equipped with line terminal jaws shall not require additional external mounting hardware. Circuit breakers shall be held in mounted position by a self-contained bracket secured to the mounting pan by fasteners. Circuit breakers of different frame sizes shall be capable of being mounted across from each other.

   d. Line-side circuit breaker connections are to be jaw type.

   e. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.

3. Electronic trip molded case full function 100% rated circuit breakers (Main Service)

   a. All electronic circuit breakers shall have the following time/current response adjustments: Long Time Pickup, Long Time Delay, [Short Time Pickup], [Ground Fault Delay] and Instantaneous settings. Each adjustment shall have discrete settings (fully adjustable) and shall be independent of all other adjustments.

   b. Circuit breaker trip system shall be a microprocessor-based true RMS sensing designed with sensing accuracy through the thirteenth (13^{th}) harmonic. Sensor ampere ratings shall be as indicated on the associated [schedule] [drawing].

   c. Local visual trip indication for overload, short circuit and ground fault trip occurrences.

   d. Long Time Pickup indication to signal when loading approaches or exceeds the adjustable ampere rating of the circuit breaker shall be provided.

   e. Communications capabilities for remote monitoring of circuit breaker trip system, to include phase and ground fault currents, pre-trip alarm indication, switch settings, and trip history information shall be provided.

   f. Circuit breaker shall be provided with Zone selective Interlocking (ZSI) communications capabilities on the short-time and ground fault functions compatible

with all other electronic trip circuit breakers and external ground fault sensing systems

g. Furnish thermal magnetic molded case circuit breakers for 250A frames and below.

4. Thermal magnetic molded case circuit breakers

a. Molded case circuit breakers shall have integral thermal and instantaneous magnetic trip in each pole.

b. Circuit protective devices shall be Square D molded case circuit breakers. Circuit breakers shall be high interrupting true current limiting*. Ampere ratings shall be as shown on the drawings.

* Manufacturer shall submit one set of published Ip and I^2t let-through curves (as required by UL) to the owner.

5. Enclosures

a. Type 1 Boxes

1) Boxes shall be galvanized steel constructed in accordance with UL 50 requirements. Zinc-coated galvannealed steel will not be acceptable.

2) Boxes shall have removable blank end walls and interior mounting studs. Interior support bracket shall be provided for ease of interior installation.

3) Maximum enclosure dimensions shall be 44” wide and 9.5” deep.

b. Type 1 Trim Fronts

1) Trim front steel shall meet strength and rigidity requirements per UL 50 standards. Shall have an ANSI 49 medium gray enamel electrodeposited over cleaned phosphatized steel.

2) Trim front shall be [4-piece surface] available in [surface] mount. Trim front door shall have rounded corners and edges free of burrs. A clear plastic directory cardholder shall be mounted on the inside of the door.

3) Locks shall be cylindrical tumbler type with larger enclosures requiring sliding vault locks with 3-point latching. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock.

c. Type 3R, 5, and 12

1) Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.

2) All doors shall be gasketed and be equipped with a tumbler type vault lock and two (2) additional quarter turn fasteners. A clear plastic directory cardholder shall be mounted on the inside of door. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock.

3) Maximum enclosure dimensions shall not exceed 44” wide and 14.5” deep.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install panelboards in accordance with manufacturer's written instructions, NEMA PB 1.1 and NEC standards.

3.02 FIELD QUALITY CONTROL

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

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

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

END OF SECTION

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

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

.3 Indicate type of multi-outlet assemblies with similar terminology to these documents.

1.2 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.3 DELIVERY, STORAGE, AND HANDLING

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

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

.3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets crates paddling and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 SURFACE RACEWAY FOR WIRING DEVICES

.1 Two piece assembly manufactured for mounting wiring devices and associated wiring.

.2 Raceway with base channel and snap on cover plate. Cross-section dimensions: as indicated.

.3 Finish: ivory enamel, as indicated.

.4 Internal barrier for raceway having power and communication.

2.2 WIRING DEVICES

.1 Wiring devices: as indicated.

.2 Communication devices: as indicated.

.3 Cover plate: to match raceway manufacturer's standard snap-on cover.

2.3 PREWIRED RECEPTACLE HARNESS

.1 Receptacle harness factory assembled with single receptacles at 1525 mm centres on 1 2 circuits.

2.4 VINYL PLASTIC STRIP

.1 Extruded rigid vinyl plastic with 2- No. 12 AWG copper wires and continuous ground strip.

.2 Unfused "U" ground lock-in receptacle for each 1.5 m of strip .

2.5 FITTINGS

.1 Elbows, tees, supports, connectors, couplings and fittings to make a complete installation.

Part 3 Execution

3.1 INSTALLATION

.1 Install multi-outlet assemblies and raceway system in accordance with manufacturer's instructions.

.2 Install supports, elbows, tees, connectors, fittings.

.3 Keep number of elbows, offsets and connections to minimum.

.4 Install barriers where required.

.5 Install surface raceway continuous around corners. Provide corner and vertical sections as required.

3.2 WIRING

.1 Install wiring after installation of raceway system is complete.

.2 Install receptacle harness as indicated.

.3 Fasten wiring with wire clips inside raceway.

.4 Install ground wire as required.

3.3 WIRING DEVICES

.1 Install wiring devices and cover plates as indicated

.2 Install vinyl strip receptacles as indicated.

.3 Install identification labels for all electrical outlets.

3.4 CLEANING

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

.2 Clean installed products in accordance to manufacturer's recommendation.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal 01 35 21 - LEED Requirements.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.3 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.42-99(R2002), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1-00, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55-M1986(July 2001), Special Use Switches.

.4 CSA-C22.2 No.111-00, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 SHOP DRAWINGS AND PRODUCT DATA

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

1.5 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Project Manger.

Part 2 Products

2.1 SWITCHES

.1 15 A, 120 V, single pole, double pole, three-way, four-way switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

.2 Manually-operated general purpose ac switches with following features:

- .1 Terminal holes approved for No. 10 AWG wire.
- .2 Silver alloy contacts.
- .3 Urea or melamine moulding for parts subject to carbon tracking.
- .4 Suitable for back and side wiring.
- .5 Ivory toggle.

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

.4 Switches of one manufacturer throughout project.

.5 Acceptable materials:

- .1 Hubbel HBL 1201 W,
- .2 Leviton 1201-2W,
- .3 Pass and Seymour.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:

- .1 Ivory urea moulded housing.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Break-off links for use as split receptacles.
- .4 Eight back wired entrances, four side wiring screws.
- .5 Triple wipe contacts and rivetted grounding contacts.

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

- .1 Ivory urea moulded housing.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Acceptable materials:

- .1 Hubbel 5262-W,

.2 Leviton 5262-W,

.3 Pass and Seymour 5262-W.

2.3 SPECIAL WIRING DEVICES

.1 Special wiring devices:

.1 Pilot lights as indicated, with neon type 0.04 W, 125 V lamp and red plastic jewel lense flush type.

2.4 COVER PLATES

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

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel 1 mm thick cover plates, plastic ivory cover plates, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.

.5 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.7 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

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

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

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

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

.3 Cover plates:

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

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers, circuit breakers, and ground-fault circuit-interrupters,.

.2 Text to complete:

.1 Section 26 23 00 - Low Voltage Switchgear.

.2 Section 26 24 02 - Service Entrance Board.

.3 Section 26 28 18 - Ground Fault Equipment Protection.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.3 Section 26 23 00 - Low Voltage Switchgear.

.4 Section 26 24 02 - Service Entrance Board.

.5 Section 26 28 18 - Ground Fault Equipment Protection.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

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

.2 Include time-current characteristic curves for breakers with ampacity of 600 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

.2 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Separate for reuse and recycling and place in designated containers Steel Metal Plastic waste in accordance with Waste Management Plan.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, Circuit breakers, and Ground-fault circuit-interrupters,: to CSA C22.2 No. 5

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

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

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

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breakers to have minimum 10kAsymmetrical rms interrupting capacity rating.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

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

2.3 MAGNETIC BREAKERS DESIGN B

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

2.4 CURRENT LIMITING AND SERIES RATED THERMAL MAGNETIC BREAKERS DESIGN C

.1 Thermal magnetic breakers with current limiters.

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

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

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

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

2.5 SOLID STATE TRIP BREAKERS DESIGN D

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

2.6 OPTIONAL FEATURES

.1 Include:

.1 Shunt trip.
.2 Auxiliary switch.
.3 Motor-operated mechanism c/w time delay unit.
.4 Under-voltage release.
.5 On-off locking device.
.6 Handle mechanism.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Equipment, fabrication and installation for ground fault protection.

.2 Text to complete Section 26 24 02 - Service Entrance Board.

.3 Text to complete Section 26 23 00 - Low Voltage Switchgear.

1.2 RELATED SECTIONS

.1 Section 01 29 83 - Payment Procedures: testing Laboratory Services.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.4 Section 01 45 00 - Quality Control.

.5 Section 26 05 00 - Common Work Results - Electrical.

1.3 PAYMENT PROCEDURES

.1 Payment for field testing of ground fault equipment performed by equipment manufacturer.

1.4 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No. 144-M91(R2001), Ground Fault Circuit Interrupters.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA PG 2.2-1999, Application Guide for Ground Fault Protection Devices for Equipment.

1.5 SUBMITTALS

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

.2 Submit product data and shop drawings.

.3 Submit test report for field testing of ground fault equipment to Engineer and certificate that system as installed meets criteria specified.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Project Manager.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 EQUIPMENT

.1 Ground fault protective equipment: components of one manufacturer.

.2 Provide ground fault protection on 1200 A, 347/600 V, 4 wire, 3 phase service: to NEMA PG 2.2 and CAN/CSA-C22.2 No. 144.

.3 Ground fault unit to contain:

.1 Ground sensing relay suitable for operation at 500 mA. Control voltage: 120 V.

.2 Ammeter with scale 0 to 5A to indicate ground current value.

.3 Three position sensitivity control switch to select value of leakage current at which relay will operate.

.4 Indicating lamp illuminated when no ground fault exists, extinguished on ground fault or test.

.5 Switch:

.1 SPDT contacts for alarm and trip.

.2 Mechanical target indication.

.3 Manually reset.

.6 Reset button for contacts and target.

.7 Suitable for panel mounting.

.4 Zero sequence transformer toroidal type with 300 - 3000 mA range.

.5 Neutral:

.1 Use an artificial neutral and grounding resistor.

.2 Use neutral ground resistor unit.

.6 System to operate instantaneously at ground current setting.

2.2 FABRICATION

.1 Install following components in equipment specified in other Sections and as indicated.

.1 Zero sequence transformer.

.2 Ground fault relay.

.3 Ground resistor unit.

2.3 RELATED EQUIPMENT

.1 Shunt trip breakers.

Part 3 Execution

3.1 INSTALLATION

.1 Do not ground neutral on load side of sensor.

.2 Install phase conductors including neutral through zero sequence transformer.

.3 Install ground fault protection system.

.4 Make connections as indicated and in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and co-ordinate with Section 01 45 00 - Quality Control if required.

.2 Arrange for field testing of ground fault equipment by ground fault equipment manufacturer before commissioning service.

.3 Demonstrate simulated ground fault tests.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Equipment and installation for ground fault circuit interrupters (GFCI).

1.2 RELATED SECTIONS

.1 Section 01 29 83 - Payment Procedures: testing Laboratory Services.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.4 Section 01 45 00 - Quality Control.

.5 Section 26 05 00 - Common Work Results - Electrical.

1.3 PAYMENT PROCEDURES

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

1.4 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.144-M91(R2001), Ground Fault Circuit Interrupters.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA PG 2.2-1999, Application Guide for Ground Fault Protection Devices for Equipment.

1.5 SUBMITTALS

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

.2 Submit product data and shop drawings.

.3 Submit test report for field testing of ground fault equipment to Engineer and a certificate that system as installed meets criteria specified herein.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Project Manager.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 MATERIALS

.1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA-C22.2 No.144 NEMA PG 2.2.

.2 Components comprising ground fault protective system to be of same manufacturer.

2.2 BREAKER TYPE GROUND FAULT INTERRUPTER

.1 Single or Two pole ground fault circuit interrupter for 15 A, 120 V, 1 phase circuit c/w test and reset facilities.

2.3 GROUND FAULT LIFE PROTECTOR

.1 100 A, 2 pole circuit breaker to supply power to mains of 100 A, 120/208 V, 3 phase panel and complete with:

.1 Automatic shunt trip breaker.
.2 Zero sequence current sensor.
.3 Facilities for testing and reset.
.4 CSA Enclosure 1 3, surface mounted.
.5 Ground fault trip indicator light.

2.4 GROUND FAULT PROTECTOR UNIT

.1 Self-contained with 15 A, 120 V circuit interrupter and duplex receptacle complete with:

.1 Solid state ground sensing device.
.2 Facility for testing and reset.
.3 CSA Enclosure 1, surface flush mounted with stainless steel face plate.

2.5 SYSTEM GROUND FAULT PROTECTION PANEL

.1 Self-contained panel suitable for 120/208 V, 3 phase, 4 wire, grounded supply. Panel to have following features:

.1 automatic 100 or 225 A breaker with shunt trip.
.2 Ground fault relay factory set at 10 mA with inverse time delay characteristics from pick-up 1 s to 0.025 s.
.3 Zero sequence current sensor.
.4 Provision for testing and reset.
.5 CSA Enclosure 1, surface mounted.
.6 Ground fault trip indicating light.

.7 Resistor type fused artificial neutral.

Part 3 Execution

3.1 INSTALLATION

.1 Do not ground neutral on load side of ground fault relay.

.2 Pass phase conductors including neutral through zero sequence transformers.

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

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and co-ordinate with Section 01 45 00 - Quality Control if required.

.2 Arrange for field testing of ground fault equipment by ground fault equipment manufacturer before commissioning service.

.3 Demonstrate simulated ground fault tests.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.3 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.

.2 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

1.3 SUBMITTALS

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

1.4 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers Steel Metal Plastic waste in accordance with Waste Management Plan.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 non-fusible, 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 three locks.

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

.4 Quick-make, quick-break action.

.5 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

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

.2 Indicate name of load controlled on size 4 nameplate.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for contactors for system voltages up to 600 V

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.3 Section 26 05 00 - Common Work Results - Electrical.

.4 Section 26 29 03 - Control Devices.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.14-95 (R2001), Industrial Control Equipment.

1.4 PRODUCT DATA

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

1.5 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Project Manager.

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..

.3 Breaker combination contactor as indicated.

.4 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.5 Mount in CSA Enclosure 1 unless otherwise indicated.

.6 Include following options in cover:

.1 Red indicating lamp.

.2 Hand-Off-Auto selector switch.

.7 Control transformer: in accordance with Section 26 29 03 - Control Devices, in contactor enclosure.

2.2 EQUIPMENT IDENTIFICATION

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

.2 Size 4 nameplate indicating name of load controlled as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install contactors and connect auxiliary control devices.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C82.1-04, Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

.2 ANSI C82.4-02(R2007), Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps Multi Supply Type.

.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)

1.2 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 review by Engineer.

.3 Photometric data to include: VCP Table where applicable and 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 and relamping schedule.

1.3 DELIVERY, STORAGE AND HANDLING

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

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

.3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets crates paddling and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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

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

.6 Disposal of old PCB filled ballasts.

Part 2 Products

2.1 LAMPS

.1 Tungsten halogen lamps to be - clear, T-3, 300 Watt, RSC base, 2000 hour lamp life, 5000 lumens; or as indicated.

.2 Fluorescent lamps to be – T5, 32 Watt, medium bi-pin, rapid-start, 4100 K, 30,000 hour lamp life, 2950 initial lumens, CRI 90; or as indicated.

.3 Pulse Start Metal halide lamps to be - clear, ED37, 400 Watt, mogul base, horizontal burn, 4000 K, 15,000 hour lamp life, 36,000 initial lumens, CRI70, open or enclosed type to suit the luminaire; or as indicated.

.4 Compact fluorescent lamps to be - 18 Watt, G24q-2 base, 12,000 hour lamp life, 12,000 initial lumens, 3700 K, CRI 85; or as indicated.

2.2 BALLASTS

.1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic IC electronic dimmable.

.1 Rating: 120 V, 60 Hz, for use with 2-32W, rapid start lamps.
.2 Totally encased and designed for 40 degrees Celsius ambient temperature.
.3 Power factor: minimum 95 % with 95% of rated lamp lumens.
.4 Current crest factor: 1.5 maximum.
.5 Harmonics: 10 % maximum THD.
.6 Operating frequency of electronic ballast: 20 kHz minimum.
.7 Total circuit power: 62 Watts.
.8 Ballast factor: greater than 0.90
.9 Sound rated: Class A.
.10 Mounting: remote, if available

.2 Metal halide ballast:

.1 Rating: 120 V, 60 Hz , for use with 1-400W metal halide lamp. Provide circuitry for quartz re-strike standby light where indicated.
.2 Totally encased and designed for 40 degrees Celsius ambient temperature.
.3 Power factor: minimum 95 % with 95% of rated lamp lumens.
.4 Type: constant wattage autotransformer

.5 Input voltage range: plus or minus 10% of nominal.

.6 Minimum starting temperature: minus 40 degrees Celsius at 90% line voltage.

.7 Mounting: outdoor integral with luminaire.

.8 Current crest factor: 1.7 maximum current.

.3 High pressure sodium ballast: to ANSI C82.4 design

.1 Rating: 120 V, 60Hz , for use with 1-400W high pressure sodium lamp.

.2 Totally encased and designed for 40 degrees Celsius ambient temperature.

.3 Power factor: minimum 95 % with 95% of rated lamp lumens.

.4 Type: reactor or solid state with matching ignitor as recommended by manufacturer.

.5 Input voltage range: plus 5% to minus 5% plus 10% to minus 10% of nominal.

.6 Minimum starting temperature: minus 40 degrees Celsius at 90% line voltage.

.7 Mounting: outdoor integral with luminaire.

.8 Current crest factor: 1.7 maximum current.

2.3 FINISHES

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

2.4 OPTICAL CONTROL DEVICES

.1 As indicated in luminaire schedule.

2.5 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.

.2 For gymnasium support luminaires above and by structural joists with 50mm angle iron.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING

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

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for emergency lighting systems.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

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

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

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141-M1985(R1999), Unit Equipment fo Emergency Lighting.

1.4 SUBMITTALS

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

.2 Data to indicate system components, mounting method, source of power and special attachments.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Project Manager.

.5 Dispose of unused batteries at official hazardous material collections site approved by Project Manager.

.6 Fold up metal banding, flatten and place in designated area for recycling.

1.6 WARRANTY

.1 For batteries, the 12 months warranty period prescribed in subsection GC32.1 of General Conditions "C" is extended to 120 months, with no-charge replacement during the first 5 years and pro-rate charge on the second 5 years.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 V, ac.

.3 Output voltage: 24 V dc.

.4 Operating time: 60 min.

.5 Battery: sealed, maintenance free.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.9 Signal lights: solid state, for 'AC Power ON'.

.10 Lamp heads: integral on unit , 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: tungsten or quartz halogen.

.11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.12 Finish: as indicated

.13 Auxiliary equipment:

.1 Ammeter.
.2 Voltmeter.
.3 Test switch.
.4 Time delay relay.
.5 Battery disconnect device.
.6 AC input and DC output terminal blocks inside cabinet.
.7 Shelf .
.8 Cord and single twist-lock plug connection for AC.
.9 RFI suppressors.

2.2 WIRING OF REMOTE HEADS

.1 Conduit: type EMT in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings

.2 Conductors: RW90 type in accordance with Section 26 05 21 - Wires and Cables 0-1000 V sized in accordance with manufacturer's recommendations

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment and remote mounted fixtures.

.2 Direct heads.

.3 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and in accordance with Section 01 91 13 – General Commissioning (Cx) requirements.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 74 11 - Cleaning.

.3 Section 01 91 13 - General Commissioning (Cx) Requirements.

.4 Section 26 05 00 - Common Work Results – Electrical.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141-02, Unit Equipment for Emergency Lighting.

.2 CSA C860-01(December 2002), Performance of Internally-Lighted Exit Signs.

.2 National Fire Protection Association (NFPA)

.1 NFPA 101-2006, Life Safety Code.

1.3 SUBMITTALS

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

.2 Product Data:

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

.2 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 STANDARD UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860.

.2 Housing: cold rolled steel minimum 1.0 mm thick, enamel finish.

.3 Face and back plates: extruded aluminum.

.4 Lamps: One two multiple - LED-12W 120 V over 500,000 hours.

.5 Operation: designed for over 100,000 hours of continuous operation without relamping.

.6 Letters: 150 mm high x 19 mm, with 13 mm thick stroke, or red on die-cast aluminum face, reading EXIT and SORTIE.

.7 Downlight: white glass in bottom of unit.

.8 Third lamp socket for emergency lamp lighting circuit.

.9 Face plate to remain captive for relamping.

2.2 SELF-POWERED UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860.

.2 Housing: cold rolled steel minimum 1.0 mm thick, enamel finish.

.3 Face and back plates: die formed cold rolled steel.

.4 Lamps: one two multiple - LED-12W 120V, over 500,000 hours.

.5 Operation: designed for over 100,000 hours of continuous operation without relamping.

.6 Letters: 150 mm high x 19 mm wide, with 13 mm thick stroke, red on die-cast aluminum face, reading EXIT and SORTIE.

.7 Downlight: white glass in bottom of unit.

.8 Third lamp socket for emergency lamp lighting circuit.

.9 Face plate to remain captive for relamping.

.10 Supply voltage: 120 V, ac.

.11 Output voltage: 24 V dc.

.12 Operating time: 60 minimum.

.13 Recharge time: 12 hours

.14 Battery: sealed, maintenance free.

.15 Charger: solid state, voltage/current regulated, inverse temperature compensated, short circuit protected, with regulated output of plus or minus 0.01 V for plus or minus 10% V input variation.

.16 Solid state transfer circuit.

.17 Signal lights: solid state, for 'AC Power ON' condition.

.18 Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment.

.1 Lamp type: as indicated.

.19 Mounting: suitable for universal mounting directly on junction box and c/w knockouts for conduit.

.1 Removable or hinged front panel for easy access to batteries.

.20 Cabinet: finish: standard.

.21 Auxiliary equipment:

.1 Lamp disconnect switch.
.2 Test switch.
.3 AC/DC output terminal blocks inside cabinet.
.4 RFI suppressor.
.5 Cord and single twist-lock plug connection for AC power supply.

2.3 DESIGN X1

.1 Recessed wall end to wall ceiling mounting.

.2 Single Double face with die-cast face plate to remain captive for relamping.

.3 Arrow: right left both directions knock-outs.

.4 Wireguard.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.

.2 Connect fixtures to exit light circuits.

.3 Connect emergency lamp sockets to emergency circuits.

.4 Ensure that exit light circuit breaker is locked in on position.

.5 Provide tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION