PART 1 - GENERAL

1.1 REFERENCES

1. Canadian Standards Association (CSA International)
    1. CSA C22.1-F2010, Quebec Building Code, chapter 5.
    2. CAN3-C235, 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, Light Gray Colour for Indoor Switch Gear.
3. Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
    1. IEEE SP1122, 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 and labels for control items in English and French.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

1. Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
2. Submit for review single line electrical diagrams under plexiglass and locate as indicated.
    1. Electrical distribution system in main electrical room.
    2. Electrical power generation and distribution systems in power plant rooms.
    3. Submit for review fire alarm riser diagram, plan and zoning of building under plexiglass at fire alarm control panel and annunciator.
    4. Shop drawings:
        a. Submit drawings which require engineering calculation, stamped and signed by professional engineer registered in the Province of Quebec.

b. 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 the Departmental Representative of these changes before they are made.

6. Manufacturer's Field Reports: submit to Departmental Representative 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.

1.5 QUALITY ASSURANCE

1. Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid licenses in accordance with authorities having jurisdiction.

2. Site Meetings:
   1. 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.
   2. After delivery and storage of products, and when preparatory Work is complete but before installation begins.
   3. Once 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 Departmental Representative with schedule within 2 weeks after award of Contract.

2. Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with the relevant section of the specifications.

1.7 SYSTEM STARTUP

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

2. Arrange and pay for services of 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.

5. For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

6. Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

1. Material and equipment to be CSA certified or another certified organism.

2. Factory assemble control panels and component assemblies.

2.2 WARNING SIGNS

1. Warning Signs: in accordance with requirements of Departmental Representative.

2. Porcelain enamel decal signs, minimum size 175 x 250 mm.

2.3 WIRING TERMINATIONS

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

2.4 EQUIPMENT IDENTIFICATION

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

1. Nameplates: plastic lamicoid 3 mm, thick plastic engraving sheet, melamine, black, matt white finish face, black 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 letters	3 mm high
Size 2	12 x 70 mm	1 line letters	5 mm high
Size 3	12 x 70 mm	2 lines letters	3 mm high
Size 4	20 x 90 mm	1 line letters	8 mm high
Size 5	20 x 90 mm	2 lines letters	5 mm high
Size 6	25 x 100 mm	1 line letters	12 mm high
Size 7	25 x 100 mm	2 lines letters	6 mm high

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

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

5. Allow for minimum of twenty-five (25) letters per nameplate and label.

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

7. Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. XXXX " as directed by Departmental Representative.

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

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

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

2.5 WIRING IDENTIFICATION

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

2. Maintain phase sequence and colour coding throughout.

3. Colour coding: to CSA C22.1.

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

2.6 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
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.7 FINISHES

1. Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
    1. Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

PART 3 - EXECUTION

3.1 INSTALLATION

1. Do complete installation in accordance with CSA C22.1 except where specified otherwise. Quebec Building Code, chapter 5, ed. 2010.

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, certification 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, plastic, 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.
    1. Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

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:
        a. General: 300 mm.
        b. Above top of continuous baseboard heater: 200 mm.
        c. Above top of counters or counter splash backs: 175 mm.
        d. In mechanical rooms: 1400 mm.
        e. Panelboards: as required by Code or as indicated.
        f. Telephone and interphone outlets: 300 mm.
        g. Wall mounted telephone and interphone outlets: 1500 mm.
        h. Fire alarm stations: 1500 mm.
        i. Fire alarm bells: 2100 mm.
        j. Television outlets: 300 mm.
        k. Wall mounted speakers: 2100mm.
        l. Clocks: 2100 mm.
        m. Door bell pushbuttons: 1500mm.

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:
    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. Insulation resistance testing:
        a. Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
        b. Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
        c. Check resistance to ground before energizing.
3. Carry out tests in presence of Departmental Representative.
4. Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
5. Manufacturer's Field Services:
    1. Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - 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 RELATED REQUIREMENTS

1. Section 26 05 00.

1.2 REFERENCES

1. Canadian Standards Association (CSA International).
    1. CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
    2. CSA C22.2 No.65, Wire Connectors.
2. Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
    1. EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
3. National Electrical Manufacturers Association (NEMA)

1.3 WASTE MANAGEMENT AND DISPOSAL

1. Separate and recycle waste materials in accordance with the general provisions of the estimate and the owner.
2. Remove from site and dispose of all packaging materials at appropriate recycling facilities.
3. Collect and separate for disposal paper, plastic, 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 Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

1. Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
2. Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less
3. Bushing stud connectors: to EEMAC 1Y-2 to consist of:
    1. Connector body and stud clamp for stranded copper conductors.
    2. Clamp for stranded copper conductors.
    3. Clamp for stranded aluminum conductors.
    4. Stud clamp bolts.

5. Bolts for copper bars.
6. Sized for conductors as indicated.

4. Clamps or connectors for armoured cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.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 C22.2 No.65.

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

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

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

1. Section 26 05 00.

1.2 PRODUCT DATA

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

1.3 DELIVERY, STORAGE AND HANDLING

1. Packaging Waste Management: remove for reuse in accordance with Departmental Representative instructions.

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, Jacketed.

3. Copper conductors: size as indicated, with thermoplastic insulation type TWU rated at 600 V.

4. Neutral supported cable: 3 phase insulated conductors of Copper and one neutral conductor of Copper steel reinforced, size as indicated. 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:
        a. Cross-linked polyethylene XLPE.
        b. Rating: 600 V.
        c. Inner jacket: polyvinyl chloride material.
        d. Armour: interlocking aluminum.
        e. Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.

f. 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 500 mm centers.

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

g. Connectors:

1) Watertight, approved for TECK cable typ.

2.3 ARMOURED CABLES

1. Conductors: insulated, copper size as indicated.

2. Type: AC90 lead sheath over cable assembly and under armour. .3 Armour: interlocking type fabricated from aluminum strip.

3. Type: ACWU90 PVC flame retardant jacket over thermoplastic armour, wet locations.

4. Connectors: anti short connectors.

2.4 ALUMINUM SHEATHED CABLE

1. Conductors: copper size as indicated.

2. Insulation: cross linked polyethylene type rated 600 V.

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

4. Outer jacket: none

5. Fastenings for aluminum sheathed cable:
    1. One hole [aluminum] [malleable iron] [steel] 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 500 mm 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 : thermoplastic jacket, and armour of closely wound aluminum wire.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

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

2. Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

3. Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

1. Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

2. Cable Colour Coding: to Section 26 05 00 Common Work Results for Electrical.

3. Conductor length for parallel feeders to be identical.

4. Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

5. 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.

6. 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.

7. 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.

3.4 INSTALLATION OF TECK 90 CABLE (0 -1000 V)

1. Group cables wherever possible on channels.

2. Install cable exposed, securely supported 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 .

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 RELATED REQUIREMENTS

1. Section 26 05 00.

1.2 REFERENCES

1. Canadian Standards Association (CSA International)
    1. CSA C22.1, Quebec Building Code, chapter 5, 2010.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

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

3. Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
    1. Provide drawings stamped and signed by professional engineer registered or licensed in Province of Quebec.

1.4 DELIVERY, STORAGE AND HANDLING

1. Waste Management and Disposal:
    1. Separate waste materials for recycling in accordance with owner’s instructions.

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: connection blocks 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 turned edge.

2.3 CABINETS

1. Construction: welded according to instructions, hinged door, handle, lock 2 keys and catch
2. Type E Empty: according to instructions.
3. Type T Terminal: as indicated containing 19 mm G1S, fir plywood backboard.

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 or as indicated.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

1. Section 26 05 00.

1.2 REFERENCES

1. Canadian Standards Association (CSA International)
    1. CSA C22.1-06, Canadian Electrical Code, Part 1, 20th Edition.

1.3 ACTION AND INFORMATIONAL 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.

1.4 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 OUTLET AND CONDUIT BOXES GENERAL

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

2.2 GALVANIZED STEEL OUTLET BOXES

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

3. 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.

2.3 MASONRY BOXES

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

2.4 CONCRETE BOXES

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

2.5 CONDUIT BOXES

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

2.6 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.

2.7 FITTINGS – GENERAL

1. Bushing and connectors with nylon insulated throats.

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

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

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

PART 3 - EXECUTION

3.1 INSTALLATION

1. Support boxes independently of connecting conduits.

2. Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

3. For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

4. Provide correct size of openings in boxes for conduit, mineral insulated and armored 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 RELATED REQUIREMENTS

1. Section 26 05 00.

1.2 REFERENCES

1. Canadian Standards Association (CSA International)
    1. CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
    2. CSA C22.2 No. 45, Rigid Metal Conduit.
    3. CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
    4. CSA C22.2 No. 83, Electrical Metallic Tubing.
    5. CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

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

3. Quality assurance submittals:
    1. Test reports: submit certified test reports.
    2. Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
    3. Instructions: submit manufacturer's installation instructions.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

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

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

PART 2 - PRODUCTS

2.1 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.
4. Reel and mark shielded cables rated 1,000 volts and above.

2.2 CONDUITS

1. Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.
2. Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
3. Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings, with expanded ends.
4. Rigid PVC conduit: to CSA C22.2 No. 211.2.
5. Flexible metal conduit: to CSA C22.2 No. 56, steel, liquid-tight flexible metal.
6. Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3.

2.3 CONDUIT FASTENINGS

1. One hole straps to secure surface conduits 50 mm and smaller.
    1. Two hole steel straps for conduits larger than 50 mm.
2. Beam clamps to secure conduits to exposed steel work.
3. Channel type supports for two or more conduits at 500 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 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. Use rigid galvanized steel threaded conduit except where specified otherwise for outdoor installations.
4. Use epoxy coated conduit in corrosive areas.
5. Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical injury.
6. Use rigid PVC conduit in corrosive areas.
7. Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
8. Use explosion proof flexible connection for connection to explosion proof motors.
9. Install conduit sealing fittings in hazardous areas.
    1. Fill with compound.
10. Minimum conduit size for lighting and power circuits: 19 mm.
11. Bend conduit cold:
    1. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
12. Mechanically bend steel conduit over 19 mm diameter.
13. Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
14. Install fish cord in empty conduits.
15. Run 25 mm spare conduits up to ceiling space and 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 flush concrete, surface type box.

16. Remove and replace blocked conduit sections.
    1. Do not use liquids to clean out conduits.

17. Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

1. Run parallel or perpendicular to building lines.

2. Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

3. Run conduits in flanged portion of structural steel.

4. Group conduits wherever possible on suspended, surface channels.

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

6. Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

1. Run parallel or perpendicular to building lines.

2. Do not install horizontal runs in masonry walls.

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

3.5 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

1. Run conduits 25 mm and larger below slab and encase in 75 mm concrete envelope.
    1. Provide 50 mm of sand over concrete envelope below floor slab.

3.6 CONDUITS UNDERGROUND

1. Slope conduits to provide drainage.

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

3.7 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 REQUIREMENTS

1. Section 26 05 00.

1.2 REFERENCES

1. Canadian Standards Association (CSA International).
    1. CSA-C22.2 No. 5, 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).

1.3 ACTION AND INFORMATIONAL 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 100 A with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

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. Collect and separate for disposal paper, plastic, 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: to CSA C22.2 No. 5

2. Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation.

3. Plug-in moulded case circuit breakers: quick- make, quick-break type, for manual and automatic operation.

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

5. Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
    1. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

6. Circuit breakers with interchangeable trips as indicated.

7. Circuit breakers to have minimum, according to instructions.

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 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.

2.5 ENCLOSURE

1. Outdoor, type 4x.

2. Indoor, type N.

PART 3 - EXECUTION

3.1 INSTALLATION

1. Install circuit breakers as indicated.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

1. Section 26 05 00.

1.2 REFERENCES

1. Canadian Standards Association (CSA International).
    1. CAN/CSA C22.2 No.4, Enclosed Switches.
    2. CSA C22.2 No.39, Fuseholder Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 WASTE MANAGEMENT AND DISPOSAL

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

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

3. Collect and separate for disposal 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. Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure to CAN/CSA C22.2 No.4, size as indicated.

2. Provision for padlocking in on-off switch position.

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

4. Fuses - Low Voltage.

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

6. Quick-make, quick-break action.

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

2.2 EQUIPMENT IDENTIFICATION

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

1. American National Standards Institute (ANSI)
    1. ANSI C82.1-97, Electric Lamp Ballasts-Line Frequency Flourescent Lamp Ballast.
    2. ANSI C82.4-92, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.
2. American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
    1. ANSI/IEEE C62.41-1991, Surge Voltages in Low-Voltage AC Power Circuits.
3. American Society for Testing and Materials (ASTM)
    1. ASTM F 1137-88(1993), Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
4. United States of America, Federal Communications Commission (FCC)
    1. FCC (CFR47) EM and RF Interference Suppression.

1.2 RELATED SECTIONS

1. Section 01 33 00 - Submittal Procedures.
2. Section 01 45 00 - Quality Control.

1.3 SHOP DRAWINGS AND PRODUCT DATA

1. Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
2. Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval by Departmental Representative.
3. Photometric data to include: VCP Table and spacing criterion.

1.4 JOB MOCK-UP

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

1.5 WASTE MANAGEMENT AND DISPOSAL

1. Place materials defined as hazardous or toxic waste in designated containers.
2. Ensure emptied containers are sealed and stored safely for disposal away from children.
3. Disposal of flourescent lamps.
4. Disposal of old PCB filled ballasts (if still existing) on renovation jobs.

PART 2 - PRODUCTS

2.1 DEL DEVICES

1. Provide LED devices whose characteristics were measured according to the latest standards IES LM-79 and LM-80 : Total luminous flux, luminous intensity distribution electrical power, efficacity, color temperature, color rendering index and luminous maintenance. Provide shop drawings which shows caracteristics.

2.2 LIGHTING

1. See plans for list of lighting

END OF SECTION