Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 02 41 17 - Selective Construction Demolition.

.2 Section 26 05 30 - Seismic Restraint Systems (SRS).

.3 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.4 Section 26 29 03 - Control Devices.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.10-10, Canadian Electrical Code, Part 1 (21st Edition) and modifications of Quebec.

.2 CAN/CSA-C22.3 No. 7-10, Underground Systems.

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

.4 CAN/CSA C282-09, Emergency Electrical Power Supply for Buildings.

.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.

1.3 DEFINITIONS

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

1.4 DESIGN REQUIREMENTS

.1 Operating Voltages: to CAN3-C235.

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

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

.3 Language Operating Requirements: provide identification nameplates for control items in English and French.

.4 Use one nameplate for both languages.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS.

.3 Submit for review single line electrical diagrams under plexiglass and locate as indicated.

.1 Electrical distribution system in main and secondary electrical room.

.2 Electrical power generation and distribution systems in power plant rooms.

.4 Submit for review 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 registered or licensed in Province of Quebec, Canada.

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure 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 Departmental Representative of these changes before they are made.

.6 Coordination Study:

.1 Using switchboard shop drawings, submit a coordination study for the protection devices, including Hydro-Québec's, the main circuit breaker, and branch circuit breakers.

.7 Erection Drawings:

.1 General:

.1 Erection drawings consist of drawings drawn to scale, showing the position of equipment and conduits with sections and details required, including dimensions of equipment and conduits, locations of ducts, openings, anchorages and supports, relative positions with structural, architectural, and other mechanical and electrical works, position of access doors, and clearances required for operation and maintenance.

.2 Prepare and submit electrical erection drawings in order to coordinate the work of the various trades of construction. Erection drawings are required for at least the following works:

.1 Electrical work located in mechanical and electrical rooms, tunnels, wells, parking lots, etc.;

.2 Electrical work located in places where space is congested with equipment, such as corridors false ceilings and in raised floors;

.3 Expected ducts, openings drillings in walls, floors, roofs, beams, and columns;

.4 Anchors;

.5 All supports located in technical shafts;

.6 In places as described in electrical specification sections;

.7 This clause is not restrictive. Erection drawings may be required in areas deemed necessary by the Departmental Representative.

.3 Erection drawings must show clearly and precisely all the work involved, those of the discipline and those made by others.

.2 Preparation:

.1 Prepare drawings at an appropriate scale, but not smaller than 1:50.

.2 Prepare erection drawings and coordinate with other mechanical and electrical trades.

.3 All erection drawings shall be prepared with the latest AutoCAD version in the form of file .DWG files, sepia, and paper, in the quantity required. AutoCAD layers of each trade shall meet PWGSC CADD Standards.

.4 Provide AutoCAD erection drawings to Division 23 for incorporation into the overall erection drawings. If necessary, revise the drawings and resubmit them to ensure full coordination and avoid incompatibilities.

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

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment or material is not available, submit such equipment or material to authority having jurisdiction for approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of Contract.

.5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

.9 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.6 FEES, PERMITS, AND INSPECTION

.1 Submit to the concerned electricity provider (Hydro-Québec), the required number of copies of drawings and specifications, to enable them to study and approve them before Work starts.

.2 Acknowledge all associated costs.

.3 Inform Departmental Representative of the changes required by the electricity provider before making any changes to the drawings or specifications. A copy of the comments made by the electricity provider (Hydro-Québec) shall be provided to Departmental Representative.

.4 Upon Work completion, get from the electricity provider (Hydro-Québec) a certificate of acceptance and forward it to the Departmental Representative.

1.7 CONNECTION OF PUBLIC UTILITIES SERVICES

.1 Submit connection request for electrical services at the locations shown on drawings from public utilities companies and coordinate Work with these companies.

.2 Check voltage and characteristics of service entrance provided by service companies in order to establish compatibility with the requirements of drawings and specifications.

.3 Disconnect the existing electrical input services rendered obsolete by the drawings and specifications.

.4 Any deviation from these requirements shall be sent in writing to Departmental Representative before the installation of services entrance, otherwise the Contractor is responsible for the changes required.

1.8 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.

.3 Site Meetings:

.1 In accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Charts.

.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.

1.9 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 reuse/recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.10 DEMOLITION

.1 Remove all existing electrical equipment as indicated and in accordance with Section 02 41 17 - Selective Construction Demolition. Equipment shall be removed at the appropriate time.

.2 All existing equipment to remove:

.1 Shall be removed with all wiring and mounting accessories from its supply point to its point of use;

.2 Becomes the property of the Contractor who shall dispose it promptly.

1.11 SYSTEM START-UP

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

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

.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.

1.12 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.

1.13 ACCEPTABLE PRODUCTS AND MATERIALS

.1 Where a particular brand name is stipulated, see Instructions to Bidders for procedure for requesting approval of substitute materials and products.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

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

.2 Material and equipment to be CSA certified. Where CSA certified material or equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.

.3 Factory assembled control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT, AND CONTROLS

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

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

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction.

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

2.4 WIRING TERMINATIONS

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

.2 All wire lugs shall be "compression" type to the appropriate size.

2.5 EQUIPMENT IDENTIFICATION

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

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

.1 For devices connected to emergency network, plates shall be red with white letterings.

NAMEPLATE SIZE

Format	Dimensions (mm)	Number of Lines	Letter Height (mm)
1	10 mm x 50 mm	1	3 mm
2	12 mm x 70 mm	1	5 mm
3	12 mm x 70 mm	2	3 mm
4	20 mm x 90 mm	1	8 mm
5	20 mm x 90 mm	2	5 mm
6	25 mm x 100 mm	1	12 mm
7	25 mm x 100 mm	2	6 mm

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

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

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

.4 Wording to be in French and in English.

.5 Disconnects, Starters, and Contactors: indicate equipment being controlled and voltage.

.6 Terminal, Cabinets, and Pull Boxes: indicate system and voltage.

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

.8 Receptacles and switches to be identified with self-adhesive plastic labels (Brother "P-Touch"), black lettering on white background, indicating panelboard name, and circuit number.

2.6 WIRING IDENTIFICATION

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

.2 Maintain phase sequence and colour coding throughout.

.3 Colour Coding: to CSA C22.1.

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

2.7 CONDUIT AND CABLE IDENTIFICATION

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

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

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

	Prime Colour	Auxiliary Colour
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 25 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow
Control	Orange	

2.8 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "Equipment Green", finish to EEMAC Y1-1.

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

2.9 FIRE-PROOFING

.1 When conduits or cables cross fire-rated walls or slabs, ensure fire and smoke tightness by using 3M products CP25, 303, FS195, and CS95, and sealing kits of 7902 and 7904 Series. Installation shall be executed according to CAN/CGSB 19.13-M87 Standard and to manufacturer’s recommendations.

2.10 SEISMIC RESTRAINT SYSTEMS

.1 Provide seismic restraint systems and devices for statically supported and vibration isolated equipment and systems according to Section 26 05 30 - Seismic Restraint Systems (SRS).

2.11 ACCESS DOORS

.1 All electrical equipment and boxes installed in false ceiling to be accessible and to have the required clearance.

.2 In the case of fixed false ceilings, ensure to have access doors to access equipment and boxes.

.1 Prioritize use of access doors provided by mechanical trades in order to locate electrical equipment and boxes in false ceiling space.

.1 Coordinate with mechanical trades locations of electrical equipment and boxes vis-à-vis access door.

.2 In case it is not possible to use access doors provided by mechanical trades because of congestion or lack of doors where required, provide access doors in sufficient quantity to ensure the required access.

.1 Access doors suitable for the type of ceiling.

.2 Access doors will be installed by Architectural Division.

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

3.4 DRILLING, OPENINGS, AND SLEEVES

.1 Execute all openings required in floor, ceiling, and walls, and supply and install all required sleeves in concrete slabs, unless specified otherwise. All existing walls, floors, ceilings, and other, damaged by the passage of wiring or installation of equipment, shall be repaired in accordance with existing finishes.

3.5 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 3 000 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.

3.6 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: 1,200 mm.

.2 Wall receptacles:

.1 General: 400 mm.

.2 Above top of continuous baseboard heater: 200 mm (minimum 400 mm from finished floor).

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

.4 In mechanical and electrical rooms: 1,200 mm.

.5 In telecommunication rooms: 915 mm.

.6 Outdoor: as indicated.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and interphone outlets:

.1 General: 400 mm.

.2 In telecommunication rooms: 915 mm.

.3 Wall-mounted: 1,500 mm.

.5 Fire alarm stations: 1,200 mm.

.6 Fire alarm bells: 2,100 mm.

.7 Thermostat: 1,200 mm.

.8 Card readers: 900 mm.

.9 Television outlets: as indicated.

.10 Wall mounted speakers: as indicated.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.8 FIELD QUALITY CONTROL

.1 Load Balance:

- .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Provide upon completion of Work, load balance report as directed in PART 1 - 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 Grounding continuity check.
- .5 Motors, heaters, and associated control equipment, including sequenced operation of systems where applicable.
- .6 Generator set and transfer switches.
- .7 Systems: fire alarm system and communications.
- .8 Insulation resistance testing:
  - .1 Megger circuits, feeders, and equipment up to 350 V with a 500 V instrument.
  - .2 Megger 350-600 V circuits, feeders, and equipment with a 1,000 V instrument.
  - .3 Check resistance to ground before energizing.

.3 Carry out tests in presence of Departmental Representative.

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

.5 Submit test results to Departmental Representative.

.6 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.

3.9 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