

PART 1 - GENERAL

1.1 GENERAL
REQUIREMENTS

- .1 All work shall be done in accordance with the latest edition of the Canadian Electrical Code and/or local inspection authorities. The electrical contractor shall obtain all permits and inspections required by law, ordinances, rules and regulations of public authorities having jurisdiction of this district and shall obtain certificates on such inspections and submit same and pay all charges in connection therewith.
- .2 Where contractor is unsure of work to be performed, he shall request direction from Departmental Representative prior to proceeding with work.
- .3 Whenever it is proposed to make a change or changes in the design, agreement or type of equipment called for in this specification, the electrical contractor shall estimate the cost of same and submit in triplicate detailed itemized estimates of the costs of all apparatus, materials and labour entering into the change or substitution.
- .4 The general contractor shall perform all cutting, patching and painting necessary for proper installation of work and shall repair any damage done employing only the services of skilled workmen. The electrical contractor shall, upon request, provide all such necessary detail and information to acquaint the general contractor with the scope of particulars of cuttings, painting and patching relevant to his work.
- .5 All equipment and exposed non-current carrying metal, conduits and parts to be permanently and effectively grounded to meet minimum requirements of the CEC Section 10 and as indicated on drawings and further specified. Standards set either by drawings or specifications which are above those covered by the CEC Section 10 are not to be reduced under any circumstances.

1.2 REFERENCES

- .1 Definitions:
 - .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.
- .2 Reference Standards:
 - .1 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.
 - .2 CSA Group
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.
 - .2 CSA C282 Electrical Emergency Power to Buildings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
 - .3 Submit for review single line electrical diagrams in glazed frames or on hardboard and locate in main electrical room and in generator room.
 - .4 Submit for review fire alarm riser diagram, plan and zoning of building in glazed frames or on hardboard at fire alarm control panel.
 - .5 Shop drawings:
 - .1 Submit drawings stamped and signed by the contractor registered or licensed in the Province of Newfoundland and Labrador, Canada.
 - .2 Submit wiring diagrams and installation details of equipment indicating mounting, layout and arrangement, control panels, accessories, and other items that must be shown to ensure co-ordinated installation.
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1.3 ACTION AND
INFORMATIONAL
SUBMITTALS
(Cont'd)

- .6 Certificates:
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and 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.

- .7 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.

- .8 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with Section 01 35 21 - LEED Requirements.
 - .2 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75% of construction wastes were recycled or salvaged.
 - .3 Building Energy and Water Consumption: submit Measurement and Verification Plan following IPMVP for monitoring end-uses as follows:
 - .1 Lighting systems and controls.
 - .2 Constant and variable motor loads.
 - .3 Variable frequency drive (VFD) operation.
 - .4 Cooling load.
 - .4 Recycled Content:
 - .1 Submit listing of recycled content products used, including details of

- 1.3 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)
- .8 Sustainable Design Submittals: (Cont'd)
- .4 Recycled Content: (Cont'd)
- .1 (Cont'd)
required percentages or recycled content materials and products.
- .5 Regional Materials: submit evidence that project incorporates required percentage of 20% regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
- 1.4 CLOSEOUT SUBMITTALS
- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
- .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
- .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
- .3 Safety precautions.
- .4 Procedures to be followed in event of equipment failure.
- .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print operating instructions and frame under glass or on hardboard material.
- .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.
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1.5 DELIVERY,
STORAGE AND
HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section 01 35 21 - LEED Requirements.
- .5 Packaging Waste Management: remove for reuse or return of pallets, crates, padding, banding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal and Section 01 35 21 - LEED Requirements.

PART 2 - PRODUCTS

2.1 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.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English and French.

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- 2.1 DESIGN REQUIREMENTS (Cont'd) .4 Use one nameplate or label for each language.
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- 2.2 MATERIALS AND EQUIPMENT .1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 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: Control Devices for conduit, wiring and connections below 50 V which are related to control systems are specified in mechanical sections and as shown on mechanical drawings.
- 2.4 WARNING SIGNS .1 Warning Signs: in accordance with requirements of Departmental Representative.
- .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 and labels as follows:
- .1 Nameplates: lamicoid 3 mm thick plastic engraving sheet black face, white core, lettering accurately aligned and engraved into core permanently attached to equipment.
- .2 Sizes as follows:
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NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
 - .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
 - .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
 - .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
 - .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
 - .7 Terminal cabinets and pull boxes: indicate system and voltage.
 - .8 Transformers: indicate capacity, primary and secondary voltages.
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2.7 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.8 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.

	<u>Prime</u>	<u>Auxiliary</u>
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Other Security Systems	Red	Yellow

PART 3 - EXECUTION

- 3.1 EXAMINATION .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- 3.2 INSTALLATION .1 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 and CSA-C22.3 No. 7 except where specified otherwise.
- 3.3 NAMEPLATES AND LABELS .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.
- 3.4 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.

3.5 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 3000 mm, and information is given before installation.

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: 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.
 - .3 Panelboards: as required by Code or as indicated. Generally 1.8 m to top of panel.
 - .4 Telephone and interphone outlets: 300 mm.
 - .5 Wall mounted interphone outlets: 1500 mm.
 - .6 Fire alarm stations: 1400 mm.
 - .7 Fire alarm bells: 2100 mm.
 - .8 Television outlets: as noted.
 - .9 Wall mounted speakers: 2100 mm.
 - .10 Clocks: as noted.
 - .11 Door bell intercom: 1500 mm.

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- 3.7 CO-ORDINATION OF PROTECTIVE DEVICES .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.
- 3.8 FIELD QUALITY CONTROL .1 Load Balance:
.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
.3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core transformers operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
.1 Power generation and 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, communications, security, CCTV.
.6 Insulation resistance testing:
.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
.3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Departmental Representative.
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- 3.8 FIELD QUALITY CONTROL (Cont'd)
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
 - .5 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- 3.9 SYSTEM STARTUP
- .1 Instruct 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 with aspects of its care and operation.
- 3.10 CLEANING
- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
 - .3 Waste Management: separate waste materials for reuse and recycling in accordance with
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3.10 CLEANING
(Cont'd)

- .3 Waste Management: (Cont'd)
Section 01 74 21 - Construction/Demolition
Waste Management and Disposal and Section
01 35 21 - LEED Requirements.
.1 Remove recycling containers and bins
from site and dispose of materials at
appropriate facility.