

1. **General Information**

1.1 **References**

- .1 Canadian Standards Association (CSA)/CSA International
 - .1 SCA C22.1, Canadian Electrical Code, Part I, Safety Standard for Electrical Installations
 - .2 B41.11 Low-Voltage Electrical Service – Standard E.21-10

1.2 **Definitions**

- .1 Electricity and electronics terms: Unless otherwise specified, the terminology applied in the present section and in the drawings is based on the definitions in the IEEE SP1122 standard.

1.3 **Design requirements**

- .1 The voltage levels must be compliant with the CAN3-C235 standard.
- .2 The engines, the electric heating appliances, the command/control/regulation and distribution devices, must function in a satisfactory manner at the frequency of 60 Hz and within the limits established in the above-mentioned standard.
 - .1 The devices must be able to function without incurring damage under the extreme conditions defined in this standard.
- .3 Operating and display language: For the purposes of identification and display, plan for identification signs and French labels for the command/control devices.

1.4 **Documents/samples to be submitted**

- .1 Submit the documents and samples required in accordance with the section 01 33 00 - Documents and samples to be submitted.
- .2 Submit the MSDS required, in accordance with the Workplace Hazardous Materials Information System (WHMIS).
- .3 Submit, for examination, the single-line diagrams framed under Plexiglas and place them in the designated areas.
 - .1 Electrical distribution network: In the main room where the electric equipment is located.

- .4 Provide, for examination, a diagram of the network's vertical distribution of the fire alarm system indicating the plan and the building zoning, framed under Plexiglas and place it near the control panel and the fire alarm annunciator panel.
- .5 Workshop drawings
 - .1 The drawings must be stamped and signed by professional engineer registered or licensed in Canada, in the province of Quebec.
 - .2 The wiring diagrams and the installation details of the devices must indicate the location, implementation, layout and the suggested arrangement, the control boards, accessories, piping, the conduits and all other elements that must be shown so that coordinated installation can be carried out.
 - .3 The wiring diagrams must indicate the circuit terminals, the internal wiring for each device, in addition to the interconnections between the various devices.
 - .4 The drawings must indicate the required clearances for the operation, maintenance and replacement of the devices.
 - .5 Submit the workshop drawings in PDF.
 - .6 If changes are required, inform the Engineer before they are carried out.

1.5 Quality control: according to section 01 45 00 - Quality Control.

- .1 Provide CSA certified equipment and materials.
- .2 If the CSA certified equipment and materials cannot be obtained, submit the suggested devices and materials to the engineer, to be approved, before delivering them to the construction site.
- .3 Submit the test results of the systems and the electric instruments installed.
- .4 Permits and rights: According to the general conditions of the contract.
- .5 Once the work is complete, submit a load balance report in accordance with the article LOAD BALANCES, SECTION 3.
- .6 Once the work is complete, submit the certificate of receipt issued by the competent authority to the Engineer.
 - .1 Workshop drawings in PDF sent by email are accepted.

1.6 Quality assurance

- .1 Qualification: The electricity work must be carried out by approved electricians,

qualified, by a master electrician or a electrical contractor with a licence delivered by the province in which the work will be carried out, or by apprentices under the provincial Act respecting vocational training and the workforce qualification.

- .1 The employees registered with a provincial training program will be able to carry out specific tasks if they are working under the direct supervision of a qualified approved electrician.
- .2 Construction site meetings
 - .1 Attend the construction site meetings as indicated

1.7 Installation start-up

- .1 Instruct the Engineer and operating staff on the operation and maintenance methods for the installation, equipment and components.
- .2 Retain and pay for the services of an engineer seconded from the manufacturer's plant to supervise the installation start-up, to verify, adjust, balance and calibrate the various components and to instruct the operating staff.
- .3 Provide these services for a sufficient length of time, by planning for the number of visits required to start-up the devices and to ensure that the operating staff is familiar with all aspects of their maintenance and operation.

1.8 Operating Instructions

- .1 Provide the operating instructions for each main system and each main device indicated in the relevant sections of the specification, for the operating and maintenance staff.
- .2 The operating instructions must include the following:
 - .1 Wiring diagrams, control diagrams, control sequence for each main system and for each device.
 - .2 The start-up, regulation, adjustment, lubrication, operation and shut down procedures.
 - .3 Safety Measures
 - .4 Procedures to be followed in the event of failure.
 - .5 Additional instructions, according to the manufacturer's recommendations for each system or device.
- .3 Provide printed or engraved instructions, placed under glass or laminated in a

manner that has been approved.

- .4 Display the instructions in the approved locations.
- .5 The operating instructions exposed to severe weather must be made from resistant material or they must be placed in a weathertight envelope.
- .6 Ensure that the operating instructions will not fade if exposed to sunlight.

2. Products

2.1 Equipment/Materials

- .1 The materials and devices must be CSA certified. If CSA certified materials or devices cannot be obtained, submit the replacement materials and equipment to the competent authority for the inspection authorities before they are delivered to the construction site, in accordance with article DOCUMENTS/ELEMENTS TO BE SUBMITTED, in SECTION 1.
- .2 The command / control panels and component sets must be assembled at the factory.
- .3 All of the electrical distribution equipment must come from the same manufacturer.

2.2 Electric motors, devices and commands/controls

- .1 Verify the installation responsibilities and coordination in terms of engines, devices and commands/controls, as indicated.
- .2 The wiring, piping and connections operating at a voltage below 50 V and related to command/control systems indicated in the sections for the mechanical systems and on the drawings of mechanical systems.

2.3 Warning signs

- .1 Warning signs: In accordance with the requirements.

2.4 Wire terminations

- .1 Ensure that the lugs, terminals and the wire termination screws are acceptable for both the copper and aluminum conductors.

2.5 Material Identification

- .1 To indicate the electrical devices, use nameplates and labels that comply with the following requirements:

- .1 Nameplates: Etched plates in 3 mm thick lamicoïd plastic with melamine facing, black matte finish and white core, mechanically secured with tapping screws, with the inscribed letters properly aligned, engraved to the core of the plate.
- .2 Format in accordance with the table below.

Nameplate format			
FORMAT 1	10 X 50 MM	1 LINE HEIGHT	3 MM LETTERS
FORMAT 2	12 X 70 MM	1 LINE HEIGHT	5 MM LETTERS
FORMAT 3	12 X 70 MM	2 LINE HEIGHT	3 MM LETTERS
FORMAT 4	20 X 90 MM	1 LINE HEIGHT	8 MM LETTERS
FORMAT 5	20 X 90 MM	2 LINE HEIGHT	5 MM LETTERS
FORMAT 6	25 X 100 MM	1 LINE HEIGHT	12 MM LETTERS
FORMAT 7	25 X 100 MM	2 LINE HEIGHT	6 MM LETTERS

- .2 Labels: Unless otherwise specified, use plastic labels with 6 mm high embossed letters.
- .3 The inscriptions on the nameplates and labels must be approved by the Engineer before manufacturing.
- .4 Plan for at least twenty-five (25) letters per plate and label.
- .5 Labels: Unless otherwise specified, use plastic labels with 6 mm high embossed letters.
- .6 The inscriptions on the nameplates and labels must be approved by the Engineer before manufacturing.
- .7 Labels: Unless otherwise specified, use plastic labels with 6 mm high embossed letters.
- .8 The inscriptions on the nameplates and labels must be approved by the Engineer before manufacturing.
- .9 Plan for at least twenty-five (25) letters per plate and label.

- .10 The nameplates for the terminal blocks and terminal box must indicate the characteristics of the network and/or voltage.
- .11 The nameplates for the disconnectors, starters and contactors must indicate the controlled device and voltage.
- .12 The nameplates for the terminal boxes and pull boxes must indicate the network and voltage.
- .13 The nameplates for the transformers must indicate the power, in addition to the primary and secondary voltages.
- .14 Identify the circuits and their source on each socket and switch with P-Touch tape.

2.6 Wiring Identification

- .1 Both ends of the phase conductors of each arterial and branch circuit must be permanently and indelibly marked with a numbered plastic tape.
- .2 Keep the same phase sequence and colour codes for the entire installation.
- .3 The colour code must be in accordance with the CSA C22.1 standard.
- .4 Use communication cables made from conductors with uniform color coding throughout the entire network.

2.7 Conduit and cable identification

- .1 Assign a colour code to conduits, boxes and metal sheathed cables.
- .2 Apply plastic tape or paint, as a means of identification, to cables or conduits every 15 m and to wall, ceiling and floor bushings.
- .3 The base colour bands must be 25 mm in width and the complementary colours 20 mm in width.

	BASE COLOURS	COMPLEMENTARY COLOUR
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 networks	GREEN	BLUE
Fire alarm	RED	
Emergency communication	RED	BLUE
Additional safety systems	RED	YELLOW

- .4 The metal tube surfaces must be finished in the workshop and be rustproofed, both inside and out, with at least two coats of enamel finish.
 - .1 Electrical equipment to be installed outside must be painted with the "green machine".
 - .2 Cabinets for indoor switch gear must be painted light gray according to the EEMAC 2Y-1 standard.

3. Execution

3.1 Installation

- .1 All equipment can be moved 3050mm by the engineer before installation at no extra charge. Confirm the placement before installation.
- .2 Unless otherwise specified, complete the entire installation in accordance with the CSA C22.1 standard.
- .3 Unless otherwise specified, install the overhead and underground networks in accordance with the CSA C22.3 standard number 1.

3.2 Labels, nameplates and data plates

- .1 Ensure that the CSA labels, nameplates and data plates are visible and readable

once the materials are installed.

3.3 Conduit and cable installation

- .1 Install the conduits and the sleeves before pouring the concrete.
 - .1 Cable crossing sleeves made of concrete: plastic pipe, with a diameter enabling the free passage of the conduit and exceeds the concrete surface by 50 mm on each side.
- .2 When using plastic sleeves for that pass through walls or floors with fire resistance, remove them before installing the conduits.
- .3 Install cables, conduits, and fittings that are to be embedded or covered with coating in a neat manner against the building truss to minimize furring thickness.
- .4 Openings in the roof and exterior walls must having flashing and protected from the weather.

3.4 Location of the sockets and outlets

- .1 Place the sockets and outlets as indicated in accordance with Section 26 05 32 - outlet boxes, junction boxes and accessories.
- .2 Do not install sockets and outlets back to back in a wall; leave a horizontal clearance of at least 150 mm between the boxes.
- .3 The location of the outlets and sockets can be changed at no additional charge, provided that it does not exceed 3000 mm and that the notice is provided before the installation.
- .4 Place the light switches near the doors on the same side as the handle.
 - .1 In the mechanical and elevator equipment rooms, place the disconnectors near the doors, on the same side of the handle.

3.5 Assembly heights

- .1 Unless otherwise indicated or prescribed, measure the assembly height of the materials from the coated floor surface to their axis.
- .2 When the assembly height is not indicated, check with the appropriate individuals before starting the installation.
- .3 Unless otherwise specified, install the equipment at the height indicated below, from the floor to the center:

- .1 Light switches: 1150 mm.
- .2 Wall outlets
 - .1 In general: 450 mm.
 - .2 Above continuous baseboard heaters: 150 mm.
 - .3 Above a worktop or its backsplash: 175 mm.
 - .4 In the mechanical rooms: 950 mm.
- .3 Switchboard panels: as required by Code or as indicated.
- .4 Sockets for telephones and intercoms: 950 mm.
- .5 Sockets for wall mounted telephones and intercoms: 1200 mm.
- .6 Fire alarm stations: 1200 mm (to be verified with the manufacturer).
- .7 Fire alarm dongs: 2300 mm.
- .8 Outlets for television sets: 450 mm.
- .9 Wall mounted speakers: 2300 mm.
- .10 Outlets for clocks: 2300 mm.
- .11 Doorbells: 1500 mm.
- .12 Panic buttons: 450 mm.
- .13 The height for specialized equipment such as fire alarms, must be coordinated with the manufacturer.

3.6 Coordination of the safety devices

- .1 Ensure that circuit protection devices such as overcurrent trip units, relays and fuses are installed, are of the correct size and are set to the required values.

3.7 On-site quality control

- .1 Load balancing
 - .1 Measure the phase current of the panel boards under normal loads (lighting) at the time of the work receipt. Distribute the branch circuit connections as to obtain the best current balance between the various phases and note the

- changes made to the original connections.
- .2 Measure the phase voltages of the devices and set the transformer sockets so that the resulting voltage is within 2% of the rated voltage of the devices.
 - .3 Once the measurements are completed, submit the required load balancing report as indicated in the DOCUMENTS/SAMPLES TO SUBMIT, PART 1. This report must show the normal load regime currents found on the phases and panel board neutrals, dry-type transformer and engine control centers. Specify the time and date that each load was measured, in addition to the circuit voltage at the time of measurement.
- .2 Carry out the tests of the following elements, in accordance with the section 01 45 00 - Quality control.
 - .1 Electricity distribution network, including phase, voltage and ground control and load balancing.
 - .2 Circuits from the distribution panel boards
 - .3 Lighting system and control / regulation devices.
 - .4 Engines, heaters and associated control / regulating devices, including controls for sequential operation of systems where applicable.
 - .5 Fire alarm system and communication network.
 - .6 Measurement of the insulation resistance
 - .1 Using a 500 V megohmmeter, measure the insulation value of circuits, distribution cables and devices rated at no more than 350 V.
 - .2 Using a 1000 V megohmmeter, measure the insulation value of circuits, arteries and devices with a nominal voltage between 350 V and 600 V.
 - .3 Check the value of the grounding resistance before turning on the power.
 - .3 Carry out the tests in the presence of the Engineer.
 - .4 Provide measuring devices, indicators, equipment and the personnel required for the test performances during the completion of the work and when the work is complete.

- .5 Controls performed on-site by the manufacturer
 - .1 Obtain a written report from the manufacturer confirming that the work meets the specified criteria for the handling, implementation, application of products, in addition to the protection and cleaning of the work and submit this report in accordance with DOCUMENTS/ELEMENTS TO SUBMIT, PART 1
 - .2 The manufacturer must make recommendations as to the use of the product (s), and visit periodically to verify whether the implementation has been carried out as recommended.
 - .3 Schedule site visits in accordance with QUALITY ASSURANCE, PART 1.

3.8 Cleaning

- .1 Clean and retouch painted workshop surfaces that have been scratched or damaged during transportation and installation; use a paint of the same type and color as the original paint.
- .2 Clean non-galvanized hooks, brackets, non-galvanized attachments and other fasteners and apply primer to protect against rust.

END OF SECTION