

**Part 1        General**

**1.1        REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-2012, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
  - .2 CAN3-C235-83 latest edition, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 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.
- .3 Perform complete installation in accordance with the National Building Code of Canada, except where specified otherwise.

**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        SCOPE OF WORK**

- .1 The work shall include but not be limited to the following:
  - .1 Provide a complete work as indicated on the drawings.
  - .2 Provide 5 copies of Operation and Maintenance materials as outlined in the specifications Section 01 33 00.
  - .3 Provide as built record drawings in electronic format and hard copy as outlined in the specifications Section 01 33 00.

**1.4        DESIGN REQUIREMENTS**

- .1 Operating voltages: to CAN3-C235 latest edition.
- .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 labels for control items in English.

**1.5 SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings:
  - .1 Submit drawings to the Engineer for approval.
  - .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 Submit number of copies of 600 x 600 mm minimum size drawings and product data to and as directed by authority having jurisdiction.
  - .5 If changes are required, notify Departmental Representative of these changes before they are made.
- .3 Record drawings:
  - .1 Keep complete record of electrical systems installed.
  - .2 Provide as built record drawings in electronic format and hard copy.
- .4 Quality Control: in accordance with Section 01 45 00 - Quality Control.
  - .1 Provide CSA certified equipment and material.
  - .2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for approval before delivery to site.
  - .3 Submit test results of installed electrical systems and instrumentation.
  - .4 Permits and fees: in accordance with General Conditions of contract.
  - .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .5 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

**1.6 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Qualifications: Electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Territorial Act respecting manpower vocational training and qualification.

- .1 Employees registered in Territorial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
- .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 Site Meetings:
  - .1 In accordance with Section 01 32 18 – Project Time Management, Planning, Monitoring And Control System – Bar (GANTT) Charts.
  - .2 Site Meetings: as part of Manufacturer's Field Services described in Part 3 - FIELD QUALITY CONTROL, in appropriate NMS Section, 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 Once during progress of Work at 99% 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 30 - Health and Safety Requirements.

#### **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.
- .2 Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

#### **1.8 SYSTEM STARTUP**

- .1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service Departmental Representative 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.

#### **1.9 OPERATING INSTRUCTIONS AND OPERATING & MAINTENANCE MANUALE:**

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

- .2 Provide operation and maintenance data, instruction, and descriptions for incorporation into maintenance manual and particular requirements of each section and as specified herein.
- .3 Provide typewritten system descriptions for each system installed in the facility. Provide step-by-step operating procedures sufficient to enable the building operators to remedy simple faults should a system failure occur, and include summaries of manufacturer's system descriptions. Tabulate according to type of system.
- .4 Provide typewritten maintenance instructions for each system installed in the facility. Provide instructions in step-by-step format. Tabulate according to type of system.
- .5 Provide original, approved shop drawings. Tabulate according to type of system.
- .6 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.
  - .6 Operation & Maintenance Manual sections to be as follows:

Main Tab: "ELECTRICAL"

Sub-Tabs: "1.0 GENERAL"  
Items Included:  
General description of the electrical portion of the project.  
Description of the layout of the O&M manual. Names, addresses, and phone numbers of Suppliers, Contractors, and Engineers.

"2.0 RECORD DRAWINGS"  
Insert record drawings in reduced format. Drawings shall be legible in reduced state.

"3.0 CERTIFICATIONS AND WARRANTIES"  
Items Included:  
Certificates of inspection, and fire alarm verification sheets and verification certificate. Contractor's warrantee.
- .7 Post instructions where directed.
- .8 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

**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 and equipment is not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

**2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS**

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

**2.3 WARNING SIGNS**

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

**2.5 EQUIPMENT IDENTIFICATION**

- .1 Identify electrical equipment with nameplates and labels as follows:
  - .1 Nameplates: lamicoid 3mm, 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	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

NAMEPLATE SIZES

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 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO." as directed by Departmental Representative.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.

**2.6 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.

**2.7 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.

	<u>Prime</u>	<u>Auxiliary</u>
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

	<u>Prime</u>	<u>Auxiliary</u>
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

**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.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Do complete installation in accordance with CSA C22.1 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 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 new electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1200 mm.
  - .2 Wall receptacles:
    - .1 General: 400 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 Telephone, fax and interphone outlets: 400 mm.
- .4 Panel boards: 2000 mm to top of panel board.
- .5 Wall Mounted Telephone And Intercom Outlets: 1200 mm.
- .6 Fire Alarm Pull Stations: 1200 mm.
- .7 End-Of-Line Resistors: 1500 mm.
- .8 Fire Alarm Bells And Visual Devices: 2450 mm.
- .9 Emergency Lighting Heads: 2450 mm.
- .10 Mounting heights of new devices to meet NBC requirements for “Barrier Free” access

**3.6 CO-ORDINATION OF PROTECTIVE DEVICES**

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

**3.7 FIELD QUALITY CONTROL**

- .1 Load Balance:
  - .1 Measure phase current to panel boards 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 Conduct following tests in accordance with Section 01 45 00 - Quality Control.

- .1 Circuits originating from branch distribution panels.
- .2 Lighting and its control.
- .3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
- .4 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 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .4 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**