

**Part 1 General****1.1 RELATED SECTIONS**

- .1 Section 01 00 10 – General Instructions.
- .2 Section 07 84 00 – Firestopping.

**1.2 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-12, Canadian Electrical Code, Part 1 (22<sup>nd</sup> Edition), Safety Standard for Electrical Installations.
  - .2 CSA C22.1-12, Canadian Electrical Code, Part 1 (22<sup>nd</sup> Edition), Safety Standard for Electrical Installations. ESA OESC-2012, Ontario Electrical Safety Code, 25<sup>th</sup> Edition, Electrical Safety Authority 2012.
  - .3 CAN/CSA-C22.3 No. 1-10, Overhead Systems.
  - .4 CAN3-C235-83(R2006), Preferred Voltage Levels for AC Systems, 0 to 50,000V.
- .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 100-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition. Institute of Electrical and Electronics Engineers.
  - .2 IEEE 1122–1998, IEEE Standard for Digital Recorders for Measurements in High Voltage Impulse Tests.

**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 1122.

**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 each language.

**1.5 SUBMITTALS**

- .1 Submittals: in accordance with Section 01 00 10 – General Instructions.
- .2 Product Data: submit WHMIS MSDS.
- .3 Shop drawings:
  - .1 Submit drawings with dimensioned layouts.
  - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, panels, accessories 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 on 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.
- .4 Quality Control: in accordance with Section 01 00 10 – General Instructions.
  - .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 special 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 Electrical Safety Authority upon completion of Work to Departmental Representative.
- .5 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within five (5) days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

**1.6 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 00 10 – General Instructions.
- .2 Qualifications: Electrical Work to be carried out by qualified, licensed electricians or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.
  - .1 Employees registered in provincial 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 00 10 – General Instructions.

- .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 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.

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

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within two (2) weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 00 10 – General Instructions.

## **1.8 SYSTEM START-UP**

- .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.

## **1.9 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.

## **Part 2 Products**

### **2.1 MATERIALS AND EQUIPMENT**

- .1 Provide material and equipment in accordance with Section 01 00 10 – General Instructions.

- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from the Electrical Safety Authority 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 the Electrical Safety Authority.
- .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: lamicoide 3 mm engraving sheet melamine, matt white finish face, black 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
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.
- .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.
- .9 Transformers: indicate capacity, primary and secondary voltages.

## 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 and at five meter 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
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
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.
  - .1 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

## Part 3 Execution

### 3.1 INSTALLATION

- .1 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 Cut openings in the building walls or floors as required to install new cables and conduits.
- .2 Prior to cutting, carry out x-ray inspection and locate sleeves in accordance with Section 01 00 10 - General Instructions.
- .3 Install new cables and conduits in openings provided in enclosure walls. Coordinate all installation with enclosure manufacturer.
- .4 Install steel sleeves through cut openings in floor slab. Sleeves to extend 150 mm above floor level. Secure sleeve with a suitable steel floor flange and clamp.
- .5 Seal openings and provide fire stopping in accordance with Section 07 84 00 – Firestopping.

**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 outlets under raised floor as indicated on the drawings.

**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 Panelboards: as required by Code or as indicated.
  - .2 Receptacles: 400 mm.
  - .3 Light switches: 1200 mm.

**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 Conduct following tests in accordance with Section 01 00 10 – General Instructions.
  - .1 Power generating 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 Systems.
  
- .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.
- .2 Carry out tests in presence of Departmental Representative.
- .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**