

## **1 General**

### **1.1 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CSA C22.1-18, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
  - .2 CAN/CSA-22.3 No. 1, Overhead Systems.
  - .3 CAN3-C235-83(R2000), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
  - .4 CSA Z462-12, Workplace Electrical Safety.
- .2 Institute of Electrical and Electronics Engineers (IEEE) / National Electrical Safety Code Product Line (NESC).
  - .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standard Terms, 7th Edition.

### **1.2 DEFINITIONS**

- .1 Electrical terms used in electrical specifications and on electrical drawings are those defined by IEEE SP1122.

### **1.3 CARE, OPERATION AND START-UP**

- .1 Instruct Departmental Representative and operating personnel in the operation, care and maintenance of systems, system equipment and components.
- .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, maintenance, and shutdown procedures.
  - .3 Safety precautions.
  - .4 Procedures to be followed in event of equipment or component failure.
  - .5 Other items of instruction as recommended by manufacturer of the system or equipment.
- .3 Print operating instructions in laminated plastic adjacent to equipment or systems interface.
- .4 Arrange and pay for manufacturer's factory service technician to supervise start-up, installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .5 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 all aspects of its care and operation.

### **1.4 DESIGN REQUIREMENTS**

- .1 Operating voltages: to CAN3-C235-83(R2000).
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

### **1.5 SITE VISIT**

- .1 Prior to tender submission visit the site and become familiar with the job and all conditions which may affect the overall cost. Ignorance of existing conditions will not be considered as basis for extra claims. Refer to Division 01 - General Requirements for additional information.

### **1.6 SUBMITTALS**

- .1 Submit shop drawings and product data in accordance with Division 01 - General Requirements.
  - .1 Submit shop drawings for all electrical equipment unless otherwise indicated.
  - .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 coordinated 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, resubmit corrected shop drawings.
- .2 Manufacturer's Field Reports: submit to Departmental Representative within 7 days of review, verifying compliance of work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.
- .3 Provide single line electrical diagrams in glazed frames or laminated sheets as follows:
  - .1 Electrical distribution system: locate in main electrical room.
- .4 Submit WHMIS MSDS information in accordance with Division 01 - General Requirements.
- .5 Upon completion of work submit As-Built Drawings, Maintenance Manuals, and Submittals in accordance with Division 01 - General Requirements.

#### **1.7 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Division 01 - General Requirements.
- .2 All electrical work is to be carried out by qualified, licensed electricians or apprentices for the province of Newfoundland & Labrador and the electrical contractor must have a valid contractor license issued by the province of Newfoundland & Labrador.
  - .1 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 The Departmental Representative reserves the right to approve the quality of material and workmanship, and to call for any tests which they deem necessary to establish the integrity of the installation during the progress of the work and a complete test of each system at the completion of the work. The cost of such tests are not to be considered as extras.
- .4 Health and Safety: in accordance with Division 01 - General Requirements.
  - .1 Protect exposed live equipment during construction for personnel safety.
  - .2 Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English.
  - .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of an electrician.
- .5 Quality Control: in accordance with Division 01 - General Requirements.
  - .1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to the authority having jurisdiction for approval before delivery to site.
  - .2 Submit test results of installed electrical systems and instrumentation.
  - .3 Upon completion of work, submit load balance report as described in PART 3 - LOAD BALANCE.
  - .4 Submit certificate of acceptance from authority having jurisdiction upon completion of work to Departmental Representative.

#### **1.8 PERMITS, FEES AND INSPECTION**

- .1 Submit to Electrical Inspection Division and Supply Authority necessary number of

drawings and specifications for examination and approval prior to commencement of work.

- .2 Pay all associated fees.
- .3 Notify Departmental Representative of changes required by Electrical Inspection Division prior to making changes.
- .4 Submit Certificates of Acceptance from Electrical Inspection Division or authorities having jurisdiction on completion of work to Departmental Representative.

#### **1.9 CO-ORDINATION**

- .1 Co-ordinate all work with work of other divisions to avoid conflict and notify Departmental Representative if any changes are required.
- .2 Locate electrical systems, equipment, and materials to provide minimum interference and maximum usable space.
- .3 Contractor to locate all existing underground services before commencing work and be responsible for any damages caused by failure to coordinate with and preserve underground services.
- .4 Where interference occurs, the Departmental Representative must approve relocation of equipment and materials regardless of installation order.
- .5 Notwithstanding the review of shop drawings, the Electrical Contractor may be required to relocate electrical equipment which interferes with the equipment of other trades, due to lack of co-ordination of the Electrical Contractor with other trades. The cost of this relocation will be the responsibility of the Electrical Contractor and the Departmental Representative will determine the extent of relocation required.
- .6 Leave space clear, and install equipment to accommodate future materials and/or equipment as indicated or specified, or to accommodate equipment and/or materials supplied by other Contractors.
- .7 Verify that the spaces in which the equipment is to be installed is sufficient and install all equipment to maintain head room and clearances, to conserve space, comply with codes, and to ensure adequate space for future servicing.
- .8 The Drawings for the Electrical work are diagrammatic performance Drawings only and are intended to convey the scope of work and indicate the general arrangement, locations, and size of equipment fixtures and outlets. The Drawings do not show Architectural, Mechanical or Structural details.
- .9 Do not scale or measure Drawings, but obtain information regarding accurate dimensions, from the dimensions shown on the Architectural Drawings or by site measurements. Follow the Electrical Drawings for laying out the work.

#### **1.10 CUTTING AND PATCHING**

- .1 Electrical Contractor to inform all other divisions in time, of required electrical openings and/or penetrations. Where this requirement is not met, the cost of all cutting and associated work to provide openings and/or penetrations will be the responsibility of the Electrical Contractor. Obtain written approval of Structural Engineer before drilling through any beams or floors. Keep hole sizes to a minimum and be responsible to repair damage caused by lack of coordination.

#### **1.11 DELIVERY, STORAGE AND HANDLING**

- .1 Provide Departmental Representative with material delivery schedule within two weeks after award of Contract.
- .2 Arrange for delivery access and unloading and/or storage areas with General Contractor.

#### **1.12 INSPECTION OF WORK**

- .1 Periodic visits to the site during construction phase will take place to ascertain reasonable conformity to plans and specifications. The Contractor will be responsible for

the execution of their work in conformity with the construction documents, the Contract, and the requirements of the inspection authority.

### **1.13 SCHEDULING OF WORK**

- .1 Work is to be scheduled in phases as described in Division 01 - General Requirements.
- .2 Become familiar with the phasing requirements for the work and comply with these conditions.
- .3 No additional monies will be paid for Contractor's requirement to comply with work phasing conditions.
- .4 Note that the Owner intends to carry on business as usual and work activities must be coordinated to maintain electrical services. Provide any required temporary work.
- .5 Work activities which disrupt occupants of the building, such as excessive noise caused by drilling of walls, floors or ceilings must be approved and scheduled in writing by the Departmental Representative at least 48 hours in advance.
- .6 All power shutdowns which affect building occupants or building operation must have prior approval of Departmental Representative and must be scheduled in writing at least 48 hours in advance with the Departmental Representative.
- .7 Overtime work, and work outside normal work hours deemed necessary to meet the schedule are the responsibility of the Contractor and must meet the requirements of the Newfoundland and Labrador - Employment Standards Act. All costs resulting from such overtime work must be included in the Contractor's total tender price.

### **1.14 FIRE RATING OF PENETRATIONS**

- .1 Provide fire stopping and smoke seal materials at openings around cabling conduits passing through floors, ceilings and fire rated walls, as required to maintain fire rating equal to the fire rated assembly.
- .2 Use ULC or approved equal fire barrier products installed in accordance with manufacturers instructions at each penetration.
- .3 Acceptable material for fire barrier products to be 3M #CP25 fire barrier caulk, #303 putty, #FS 195 wrap and #CS195 sheet.

## **2 Products**

### **2.1 PRIOR APPROVAL OF PRODUCTS**

- .1 The use of any product not listed by name in the specification must be approved by Departmental Representative prior to tender submission.
- .2 By using pre-approved product substitutions the Contractor accepts the responsibility and associated costs for all required modifications to circuitry, devices and wiring. The Contractor is to submit shop drawings with deviation from the original design highlighted to the Departmental Representative for review and approval prior to rough-in.

### **2.2 MATERIALS AND EQUIPMENT**

- .1 Provide materials and equipment in accordance with Division 01 - General Requirements.
- .2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Division prior to delivery and submit such approval as described in Part 1 - Submittals.

### **2.3 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 electrical equipment enclosures light grey to EEMAC 2Y-1.

## 2.4 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Inspection Department.
- .2 Porcelain enamel or acrylic 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 All junction and pull boxes are to be marked with an indelible ink marker to designate the circuit number of enclosed wiring, the designated panel name and electrical characteristics. Where boxes are painted in exposed areas, information is to be written on inside of box cover.
- .2 Identify electrical equipment with nameplates and labels as follows:
  - .1 Nameplates: Lamicoid 3 mm thick plastic engraving sheet, black white face, black white core, mechanically attached with self tapping screws.
  - .2 Sizes as follows:

-----  
NAMEPLATE SIZES:  
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|        |             |         |                    |
|--------|-------------|---------|--------------------|
| 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 line  | 6 mm high letters  |

- .3 Labels:
  - .1 Embossed plastic labels with 6 mm high letters unless specified otherwise.
- .4 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .5 Allow for average of twenty-five (25) letters per nameplate and label.
- .6 Identification to be English.
- .7 Nameplates for pull boxes and junction boxes to indicate system name and voltage characteristics.
- .8 Nameplates for disconnects and contactors to indicate equipment being controlled, wire, voltage, phase, number of power source and branch circuit breaker number.
- .9 Nameplates for pull boxes, splitters and panelboards to indicate system name, overcurrent protection device rating, voltage, phase, and number of wire, and power source.
- .10 Where applicable, nameplates for transformers to indicate capacity, primary and secondary voltages and transformer number.
- .11 Lamicoid nameplate installed on panelboards and splitter troughs shall indicate the following:
  - .1 Designated name of equipment.
  - .2 Voltage, number of phases and wires.
  - .3 Designation of power source.

- .4 The following is an example:

|                               |
|-------------------------------|
| PANEL 'A' 120/208V - 1PH - 3W |
| SERVICE RATED ENTRANCE        |

- .12 Lamicoid nameplates installed all various system controls, control panels, contactors, disconnect switches, and large junction and pull boxes shall contain the following information:

- .1 Designated name of equipment.
- .2 Designated name of power source.
- .3 Voltage, number of phases and wires.
- .4 Branch circuit breaker number(s) where possible.
- .5 The following is an example:

|                            |
|----------------------------|
| PV SOLAR ARRAY             |
| 208V-1PH, FED FROM PNL 'A' |

- .13 Install an additional nameplate on all, or any piece of electrical equipment, or apparatus, i.e. Main Switchboard, CDP panels, panelboards, motor control centres, and fusible switches, etc., that may contain overcurrent devices, i.e. circuit breakers and/or fuses, that have been designed for, and incorporate an interrupting capacity sized "larger" than 10 KAIC.

Example:

|  |  |
|--|--|
| Minimum interrupting capacity of breakers installed in this panel is to be not less than 22 KAIC | Minimum interrupting capacity of fuses installed in this switch are to be not less than 100 KAIC |
|--|--|

## 2.7 WIRING IDENTIFICATION

- .1 Identify wiring with indelible pre-printed self-adhesive vinyl tape, indicating panel and circuit number. Wiring to be identified at both ends and at junction, pull boxes and splices.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1-18, Canadian Electrical Code.

## 2.8 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
  - .1 Colour coding of electrical boxes and their associated covers located in finished areas to be applied to the inside cover and box.
- .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.

- .1 Colours indicated below are for reference only. If an existing colour coding scheme exists within the building, then the existing colour coding scheme is to be utilized.

| SYSTEM            | PRIME COLOR | AUXILIARY COLOR |
|-------------------|-------------|-----------------|
| 208/120V (normal) | Yellow      | -----           |
| 208/120V (solar)  | Yellow      | Blue            |
| Low Voltage       | Purple      | -----           |

### 3 Execution

#### 3.1 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

#### 3.2 LOCATION OF EQUIPMENT

- .1 Change location of equipment at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

#### 3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete. 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 to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.  
.4 Prior to rough-in, coordinate locations of conduit runs with other trades.

#### 3.4 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless indicated otherwise.  
.2 If mounting height of equipment is not specified or indicated, verify with Departmental Representative before proceeding with installation.  
.3 Install electrical equipment at the following heights:  
.1 Local switches: 1200 mm.  
.2 Panelboards: 1600 mm or as required by Code.  
.3 Luminaires: as indicated in the Luminaire Schedule.

#### 3.5 CO-ORDINATION OF PROTECTIVE DEVICES

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

#### 3.6 FIELD QUALITY CONTROL

- .1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program will be permitted, under the direct supervision of a qualified licensed electrician.  
.1 Permitted activities are to be determined based on the level of training attained and the demonstration of ability to perform specific duties.  
.2 The work of this division to be carried out by a contractor who holds a valid Code 1 Electrical Contractor License as issued by the Province.  
.3 Load Balance:  
.1 Measure phase current to panelboard 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. Coordinate with Utility for balancing of service transformers.
- .3 Submit, at completion of work, report listing phase and neutral currents on panelboards, solar array inverters and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.
- .4 Conduct and pay for following tests in accordance with Division 01 - General Requirements.
  - .1 Renewable energy generators, including phasing, voltage, grounding, load balancing, commissioning and training.
  - .2 Circuits originating from branch distribution panels.
  - .3 Lighting and its control.
  - .4 Motors and associated control equipment including sequenced operations of systems where applicable.
  - .5 Ground system continuity and resistance test.
- .5 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .6 Insulation resistance testing for:
  - .1 Megger and record circuits, incoming service feeders and wiring to distribution panels up to 350 V with a 500 V instrument.
  - .2 Megger and record 350 – 600 V circuits, feeders and equipment with a 1000 V instrument.
  - .3 Check resistance to ground before energizing and record value.
- .7 Provide instruments, meters, equipment and personnel required to conduct tests during and conclusion of project.

### **3.7 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.
- .3 Clean luminaire lenses, housings, louvers, etc. upon completion of construction.
- .4 All electrical panelboard and similar components must be vacuumed completely before turning over to the Departmental Representative.

**END OF SECTION**