

PART 1 **GENERAL**

1.1 **GENERAL**

- .1 This Section covers items common to Sections of Division 26. This section supplements requirements of Division 1, Division 23 and Division 33.

1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
 - .2 CAN/CSA-22.3 No. 1, Overhead Systems.
 - .3 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

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, 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 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.
- .4 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
- .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 SUBMITTALS

- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.
- .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, 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 of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .5 Quality Control: in accordance with Section 01 45 00 - Quality Control.
 - .1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.
 - .2 Submit test results of installed electrical systems and instrumentation.
 - .3 Submit, upon completion of Work, 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.
- .6 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.

1.6 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- .1 Submit shop drawings in accordance with Division 01 - Section 01 33 00 – Submittal Procedures.
- .2 Show on shop drawings details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
- .3 Where applicable, include wiring, single line and schematic diagrams.
- .4 Include wiring drawings or diagrams showing interconnection with work of other divisions are required.
- .5 Each shop drawing shall be stamped and signed by the Contractor before submitting, stating that he has checked the drawings against the requirements as called for in the contract documents, and also in the case here the equipment attached to or connects to other equipment, that it has been properly co-ordinated with this equipment, whether supplied under the Electrical Division or under other Divisions.

- .6 Each shop drawing for non-catalogue items shall be prepared specifically for this project. If brochures are submitted for catalogue items, the brochures shall be marked definitely indicating the item or items to be supplied.
- .7 Work shall not be proceeded until final review of shop drawings are received by the Contractor.
- .8 Shop Drawing Review is for general compliance with contract documents. No responsibility is assumed by the Departmental Representative for correctness of dimensions or details. Corrections or comments made on the shop drawings during the Departmental Representative's review do not relieve the Contractor from compliance with the requirements of the drawings and specifications.

1.7 OPERATION AND MAINTENANCE DATA

- .1 Submit operation and maintenance data in accordance with Division 01.
- .2 Include in manuals information based on following requirements:
 - .1 Operation and maintenance instructions to be sufficiently detailed with respect to design elements, construction features and component function and maintenance requirements, to permit effective startup. Operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
 - .2 Technical data to be in the form of approved shop drawings, project data, supplemented by bulletins, component illustrations, exploded views technical descriptions of items, and parts lists. Advertising of sales literature will not be accepted.
 - .3 Provide wiring and schematic diagrams and performance curves.
 - .4 Include names and addresses of local suppliers for all items included in maintenance manuals.
 - .5 Material to be in English.

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 associated fees.
- .3 Departmental Representative will provide drawings and specifications required by Electrical Inspection Division and Supply Authority at no cost.
- .4 Notify Departmental Representative of changes required by Electrical Inspection Division prior to making changes.

- .5 Furnish 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 work with work of other divisions to avoid conflict.
- .2 Locate distribution systems, equipment, and materials to provide minimum interference and maximum usable space.
- .3 Locate all existing underground services and make all parties aware of their existence and location.
- .4 Where interference occurs, Departmental Representative must approve relocation of equipment and materials regardless of installation order.
- .5 Notwithstanding the review of shop drawings, this division may be required to relocate electrical equipment which interferes with the equipment of other trades, due to lack of co-ordination by this Division. The cost of this relocation shall be the responsibility of this Division. The Departmental Representative shall decide the extent of relocation required.

1.10 CUTTING AND PATCHING

- .1 Inform all other divisions in time, concerning required openings. Where this requirement is not met, bear the cost of all cutting. Openings of 200 mm or smaller shall be the responsibility of Division 26. Openings larger than 200 mm shall be the responsibility of Division 1. Obtain written approval of Structural engineer before drilling any beams or floors.

1.11 PROTECTION

- .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 electrician.

1.12 RECORD DRAWINGS

- .1 Obtain and pay for three sets of white prints. As the job progresses, mark these prints to accurately indicate installed work. Have the white prints available for inspection at the site at all times and present for scrutiny at each job meeting.

- .2 Show on the record drawings the installed inverts of all services entering and leaving the building and the property. Dimension underground services at key points of every run in relation to the structure and building.
- .3 Indicate exact location of all services for future work. Show and dimension all work embedded in the structure.
- .4 Submit record drawings within 30 days prior to start of commissioning.

1.13 INSPECTION OF WORK

- .1 The Owner will make periodic visits to the site during construction to ascertain reasonable conformity to plans and specifications but will not execute quality control. The Contractor shall be responsible for the execution of his work in conformity with the construction documents and with the requirements of the inspection authority.

1.14 SCHEDULING OF WORK

- .1 Work shall be scheduled and coordinated with Owner Representative.
- .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.

1.15 FIRE RATING OF PENETRATIONS

- .1 Maintain fire ratings around conduits passing through floors, ceilings and fire rated walls.
- .2 Use 3M brand or equal fire barrier products at each penetration.
- .3 Acceptable products for fire barrier products shall be 3M #CP25 fire barrier caulk, #303 putty, #FS 195 wrap and #CS195 sheet.
- .4 Acceptable manufacturers: Nelson, Fire Stop Systems, 3M or approved equal. Material of same manufacturer to be used throughout project..

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product 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.
- .3 Factory assemble control panels and component assemblies.

2.2 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 switchgear and distribution enclosures light grey to EEMAC 2Y-1.

2.3 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Inspection Department and Departmental Representative.
- .2 Porcelain enamel decal signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

- .1 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

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:
 - .1 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 average of twenty-five (25) letters per nameplate and label.
- .5 Identification to be English.
- .6 Nameplates for terminal cabinets and junction boxes to indicate system name and voltage characteristics.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system name and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages and transformer number.

2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or 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 code: to CSA C22.1, Canadian Electrical Code.
- .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>Conduit System</u>	<u>Prime Color</u>	<u>Auxiliary Color</u>
up to 250 V	Yellow	
up to 600 V	Yellow	Green

PART 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 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.

3.3 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 Pedestal receptacles as indicated on drawing details.
 - .2 Light fixtures on wooden poles as indicated on drawing details.
 - .3 Panelboards: as required by code or as indicated.

3.4 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.5 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 shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks – the activities permitted shall 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 Submit, at completion of work, report listing phase and neutral currents on panelboards, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

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- .4 Conduct and pay for following tests:
 - .1 Power 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 operations of systems where applicable.
 - .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.
 - .1 Megger and record circuits, feeders and equipment 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 Carry out tests in presence of Departmental Representative.
 - .8 Provide instruments, meters, equipment and personnel required to conduct tests during and conclusion of project.
 - .9 Submit test results for Departmental Representative's review and include in Commissioning Manuals specified in Section 01 91 13 – Commissioning (Cx) Requirements.
- 3.6 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.
- 3.7 MATERIAL SPECIFIED**
- .1 Where substitutions are to be submitted for materials bearing the clause "or approved equal", approval of the substitute item must be submitted to the Departmental Representative at least TEN DAYS PRIOR to the closing date of the tender. The proposed substitution shall show product name, complete specification and be equal to, or better than the named item. No increase in the tender price shall be made for such a substitution should it be accepted. Accepted equals will be listed in an addendum seven days prior to the Trade closing date.

- .2 Where additional manufacturers are named under Articles entitled "Approved Manufacturers", the choice of which of the manufacturers named in reference to a particular article is to be used, shall be the Contractors.
- .3 Materials or product specified without the clauses "or approved equal" or "approved manufacturers" shall be supplied as specified and no proposed substitution will be considered.
- .4 Where approvals are granted for the use of other equipment any and all changes or additions required for the installation or operation of the approved equipment will be made by the Contractor at his own expense and no claims will be approved for any such changes, notwithstanding approval of shop drawings. Equipment that is accepted and installed and then does not perform as represented by original submitted data shall be replaced by the Contractor with equipment as specified, at no charge to the Canada.

3.8 EXAMINATION OF OTHER WORK DRAWINGS, CHANGES

- .1 This Division requires the examination of the material and work of all other Divisions upon which the work of this Section depends for proper completion. Any defect in work, levels, or materials, shall be reported to the Departmental Representative. The work of this Division shall not commence until such defects have been corrected.

3.9 DRAWINGS, CHANGES ACCESSIBILITY

- .1 The drawings shall be considered to show the general character and scope of the work and not the exact details of the installation.
- .2 The installation shall be completed with all supports and accessories required for a complete operative and satisfactory installation.
- .3 The location, arrangement and connection of equipment and material as shown on the drawings represents a close approximation to the intent and requirements of the Contract.
- .4 The right is reserved by the Departmental Representative to make reasonable changes required to accommodate conditions arising during the progress of the work. Such changes shall be done at no extra cost to Canada, unless the location, arrangement or connection is more than 1.5 m from that shown.
- .5 Actual location of existing services shall be verified in the field where necessary before work is commenced.
- .6 Changes and modifications necessary to ensure co-ordination and to avoid interference or conflicts with other trades, or to accommodate existing conditions, shall be made at no extra cost to Canada.

3.10 CONTRIBUTION IN AID

- .1 Contractor shall include all contribution in aid expenses incurred by power utility company in contract price. Consult with power company prior to bidding for amount carried.

END OF SECTION