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**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 20 05 01 Common Work Results for Mechanical.

**1.2 REFERENCES**

- .1 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.
- .2 Reference Standards:
  - .1 Canadian Standards Association (CSA)
    - .1 CSA C22.1-18, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
    - .2 CAN/CSA-C22.3 No.1-15, Overhead Systems.
    - .3 CAN3-C235-83(R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
    - .4 CSA C282.09, Emergency Power Supply for Buildings.
  - .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.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit WHMIS MSDS in accordance with Construction and Hazardous Materials Section.
- .3 Submit for review single line electrical diagrams. Once approved the single line diagram shall be displayed in the electrical room under Plexiglas. Exact location to be determined on site. Single line diagram must include a minimum of the following:
  - .1 Service entrance.
  - .2 Electrical distribution system.
  - .3 Back-up power system.
- .4 Submit for review fire alarm riser diagram, plan and zoning of building. Once approved the fire alarm riser diagram is to be installed under Plexiglas at fire alarm control panel and annunciator.

- .5 Shop drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Newfoundland, Canada.
  - .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 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
  - .5 Submit required number of copies of 600 x 600 mm minimum size drawings to authority having jurisdiction.
  - .6 If changes are required, notify Departmental Representative of these changes before they are made.
- .6 Certificates:
  - .1 Provide CSA certified equipment and material.
  - .2 Where CSA certified equipment or material is not available, submit such equipment and material to authority having jurisdiction for approval by a certified agency of Standard Council of Canada (SCC) 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, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
  - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .7 Manufacturer's Field Reports: submit to Departmental Representative and Engineer manufacturer's written report, within 3 days of review, verifying compliance of Work of electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

#### **1.4 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
  - .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.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.
- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.
- .3 In addition to technical data the Electrical Contractor shall also include:
  - .1 Names, addresses and phone numbers of local supplier for items included in the maintenance manual
  - .2 Copy of reviewed shop drawings.
  - .3 Copy of Electrical Specifications.
  - .4 Names, addresses and phone numbers of Electrical Sub-contractors.
  - .5 Inspection certificates and verification reports.
  - .6 Letter or certificate of warranty.

## **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Material Delivery Schedule: Provide Departmental Representative with schedule within 2 weeks after award of contract for all long delivery items.
- .3 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .4 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect materials from damage to finish or material.
  - .3 Replace defective or damaged materials with new.
- .5 Packaging Waste Management: remove for reuse and recycling of pallets, crates, or packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **1.6 ADDENDA AND REVISIONS**

- .1 All addenda, instructions and revisions issued during the tendering period shall become part of the Contract Documents and shall be included in the Tender, and shall take precedence over the previous instructions.
- .2 The Departmental Representative and Engineer reserve the right to make revisions to the drawings during the period of construction and these shall take precedence over previously issued drawings. All revisions to the work shall be executed by duly authorized change orders

with the amount of addition or deduction to the contract amount approved by the Departmental Representative before the execution of any work associated with the revision is undertaken.

## **1.7 SUBSTITUTIONS**

- .1 It is the intent of these drawings to establish the required quality of materials. Where manufacturer names or catalogue references are used, it is done in order to establish the required quality, style, size or function. Products of other manufacturers will not be permitted after the signing of the contract. The decision as to suitability shall rest with the Departmental Representative.
- .2 Should the contractor propose to furnish material and equipment other than those specified, they shall submit a written request for any or all substitutions prior to the tender closing date. Such a request shall be accompanied by a complete description including manufacturer, brand name, catalogue number and technical data for all items. If requested by the Departmental Representative, the contractor shall submit for inspection a sample of the proposed item.
- .3 All material not meeting the specifications above shall not be allowed on the project site.
- .4 Substitutions affecting the design will not be permitted. Additional costs to any other trade as a result of a change or substitution by this contractor shall be the responsibility of this contractor.
- .5 The listing of a manufacturer as acceptable does not imply acceptance of all products of that manufacturer and only products meeting the specifications will be accepted.

## **1.8 SCOPE OR WORK**

- .1 The Electrical Contractor shall furnish all labour, material, tools, appliances and equipment to entirely complete and provide the operation of the electrical systems.
- .2 The overall intention is to provide a functioning complete electrical installation in all aspects, and all items reasonably inferable as called for by the drawings and specifications, and by normally accepted good practice, notwithstanding that every item necessarily required may not be particularly mentioned. This Contractor shall fulfill his obligation and not take advantage of any unintentional errors or omissions, should any exist, to the detriment of the Departmental Representative interest. The work shall include but not be limited to:
  - .1 Removals or relocations of existing electrical equipment as specified on drawings.
  - .2 Lighting and associated electrical conduits and wiring of switches, fixtures, and receptacles as indicated.
  - .3 Emergency lighting and exit signs.
  - .4 Fire alarm system.
  - .5 Connections of equipment supplied and installed by others.
  - .6 Installation, testing and certification of fire alarm detection system.
  - .7 Grounding and bonding.
  - .8 Coordination with other trades.

## **1.9 ELECTRICAL DRAWINGS**

- .1 The electrical drawings which constitute an integral part of this contract shall serve as working drawings. They indicate the general layout of the complete electrical system arrangements of

feeders, circuits, outlets, switches, controls, panelboards, service equipment, communications, fire alarm systems, underground duct banks, overhead pole lines, power center, etc..

- .2 Field verification of scale dimensions on drawings is directed since actual locations, distances, and levels will be governed by the field conditions.
- .3 All discrepancies related to the electrical work shall be promptly brought to the attention of the Departmental Representative and Engineer for clarification.

## **1.10 EXISTING CONDITION AND EXAMINATION OF DRAWINGS**

- .1 The Electrical Contractor shall become completely familiar with the drawings and specifications, as well as construction methods of other trades related to the work to avoid possible interferences on the project. Should drastic changes be necessary to resolve such conflicts, this Contractor shall notify the Departmental Representative and Engineer and secure written approval and agreement on the necessary adjustments before the installation is started.
- .2 Before submitting the tender, this Contractor shall visit the site and become familiar with site conditions, availability of storage space and all other factors that might influence the tender submittal.
- .3 The contractor shall determine all working conditions and rigidly comply. Conditions that require special consideration include but not limited to: Dust, Noise, Vibration, Water, Working hours, Continuity of power, Access to area of work, Physical protection of Departmental Representative facility and equipment.
- .4 No extras will be allowed due to failure to account for site conditions or working conditions.
- .5 The exact rough in dimensions and connection points shall be determined from shop drawings and on site measurements.

## **Part 2 Products**

### **2.1 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 and labels for control items in English and French.
- .4 Use one nameplate or label for both languages.

### **2.2 MATERIALS AND EQUIPMENT**

- .1 Provide material 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 are not available, for approval by a certified agency of Standard Council of Canada (SCC) before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

## **2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS**

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring conduit: in accordance with Section 26 05 34 – Conduit, Conduit Fastenings and Conduit Fittings. All wiring and connections below 50 V which are related to control systems specified in mechanical sections or as shown on mechanical drawings shall not be the responsibility of this contractor unless otherwise noted.

## **2.4 WARNING SIGNS**

- .1 Warning Signs: in accordance with requirements of inspection authorities and Departmental Representative.
- .2 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 Identify electrical equipment with nameplates as follows:
  - Nameplates: plastic laminate lamacoid 3 mm matt white finish face, black core, lettering accurately aligned and engraved into core mechanically attached with self-tapping screws.

.1 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 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 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Upon completion of project, contractor to relabel/update all lamicoid nameplates on all existing panelboards, disconnects, transformers, etc and new typed panel directories to reflect all changes.

**2.7 WIRING IDENTIFICATION**

- .1 Identify wiring with permanent indelible identifying markings, numbered 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.

**2.8 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.
- .4 Confirm color coding with Departmental Representative.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Fire Alarm	Red	
Controls	Brown	Orange

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**2.9 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.
  - .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC-2Y-1.

**2.10 COORDINATION STUDY**

- .1 Prior to adjusting the electronic trip unit as described below, provide high resolution pictures to the engineer of the following breakers and their trip unit settings:
  - .1 Generator breaker located inside generator enclosure
  - .2 100A-3P breaker feeding ATS #1, located inside panel 'EDPA'
- .2 Once pictures are received, the Engineer will verify the existing settings and will notify the electrical contractor on how to proceed with adjustments.
- .3 The electrical contractor is responsible to adjust the electronic trip unit settings on the following breakers:
  - .1 Generator breaker located inside generator enclosure
    - .1 ltpu: remains as is
    - .2 ltd: remains as is
    - .3 stpu: 3
    - .4 std: 0.1
    - .5 inst: 4
  - .2 100A-3P breaker feeding ATS #1 located inside panel 'EDPA'
    - .1 Allow for adjustments if required.
  - .3 Provide photo's once changes are completed.

**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 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.

### **3.4 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 Local switches: 1200 mm.
  - .2 Wall receptacles:
    - .1 General: Match existing.
  - .3 Panelboards: as required by Code or as indicated.
  - .4 Fire alarm horn/strobe: 2300 mm.
  - .5 Exit sign: 300mm above door frame.
  - .6 Backbox for thermostats: Confirm height with Mechanical Contractor.

### **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 CO-ORDINATION WITH SUPPLY AUTHORITY**

- .1 Utility coordination allowance, include all customer contributions required by the supply authorities in the tender price. The contractor shall include a sum of one thousand five hundred dollars (\$1,500.00) for the utility customer allowance for any coordination work required by the utility companies. The final amount will be adjusted by change order based on actual invoiced amount from the utilities of electrical system.
- .2 Electrical energy service: the electrical contractor will make the necessary arrangements with the Departmental Representative and NFLD Power commission and authorities to have electrical energy disconnected/re-connected to the site in accordance with the intent of this specification and drawings. Any material, apparatus, equipment's and labour not provided by the power commission for the work will be provided by the electrical contractor and must be to the complete satisfaction of the power commission.
- .3 Credit shall be issued to the contractor if no utility coordination pricing is provided on behalf of the utility.

### **3.7 CO-ORDINATION WITH OTHERS**

- .1 Electrical contractor shall co-ordinate the installation of equipment to minimize inconvenience to Departmental Representative and other sub-contractors.

- .2 Work by other contractors will be done concurrently with work in this contract. This contractor shall schedule and arrange the work and store materials in co-operation so as to avoid interference with others.

### **3.8 CUTTING, PATCHING AND PAINTING**

- .1 The contractor shall be responsible for all cutting required to complete the work shown on the drawing and described herein.
- .2 All holes through concrete or masonry shall be made by core drilling. Care must be taken to contain dust and debris.
- .3 Seal all holes and opening using an approved non-shrink fire proof compound. The contractor shall be certified for fire stopping installation. All fire stopping shall be done in accordance to the manufacturers instructions.
- .4 The contractor shall neatly patch all surfaces cut or damaged as a result of this contract.
  - .1 All patching shall be of matching material and carried out by tradesmen trained and skilled in the work to be done.
- .5 The contractor shall re-paint all surfaces as required. All painting shall be carried out by skilled tradesmen.
- .6 All patching, painting and sealing shall be to the satisfaction of the Departmental Representative and Engineer.

### **3.9 FIELD QUALITY CONTROL**

- .1 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 and 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 task.
  - .2 Permitted activities: determined based on the training level attained and demonstration of ability to perform specific duties
- .2 Health and Safety Requirements: Complete construction in accordance with occupational health and safety regulations.
- .3 Load Balance:
  - .1 Measure phase current to panelboards 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.
  - .3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

- .4 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
  - .1 Power distribution system including phasing, voltage, grounding and load balancing.
  - .2 Emergency power system as per testing described.
  - .3 Circuits originating from branch distribution panels.
  - .4 Lighting and its control.
  - .5 Heaters and associated control equipment including sequenced operation of systems where applicable.
  - .6 Insulation resistance testing:
    - .1 Test insulation resistance of branch and feeder conductors prior to connection to panels or switchgear.
    - .2 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
    - .3 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
    - .4 Check resistance to ground before energizing.
    - .5 Submit results to Engineer for review.
    - .6 Testing methods and test results: To CSA, CEC and Authorities Having Jurisdiction.
    - .7 Remove and replace conductors found damaged, with new material.
    - .8 Provide required labour and tools, if during testing Engineer requests equipment be opened and removed from their housings to examine equipment, terminations and connections.
- .5 Carry out tests in presence of Departmental Representative and Consultant.
- .6 Voltage Tests: Ensure voltage drop at maximum potential drop of 2% for 120 V, and 208V branch circuits, 3% on feeder circuits. Voltage drop shall meet CEC and ASHRAE requirements.
- .7 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .8 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 - ACTION AND INFORMATIONAL 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.

### **3.10 SYSTEM STARTUP**

- .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.
- .4 Complete commission as per Section 01 09 13 – General Commissioning Requirements

### **3.11 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.12 RECORD DRAWINGS**

- .1 Refer to Section 01 78 00 – Closeout Submittals.
- .2 Two sets of white prints shall be maintained for the exclusive purpose of recording deviations from that shown on the contract drawings. One set shall be kept up to date at all times. At the completion of the project the information shall be transferred to the second set of drawings and to a set of reproducible CAD drawings. Both sets shall be turned over to the Departmental Representative.

### **3.13 GUARANTEE**

- .1 Guarantee material and workmanship to be free from defect for a period of one (1) year or longer where specified otherwise, after issuing of the certificate of substantial completion.
- .2 Make good, at the Departmental Representatives convenience, all defects covered by this guarantee without additional cost to the Departmental Representative.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 26 05 00 Common Work Results for Electrical.

**1.2                REFERENCES**

- .1            CSA International
  - .1            CAN/CSA-C22.2 No.18-06(R2016), Outlet Boxes, Conduit Boxes and Fittings.
  - .2            CAN/CSA-C22.2 No.65-03(R2008), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2            Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
  - .1            EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3            National Electrical Manufacturers Association (NEMA)

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Product Data:
  - .1            Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4                CLOSEOUT SUBMITTALS**

- .1            Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2            Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

**1.5                DELIVERY, STORAGE AND HANDLING**

- .1            Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .2            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3            Storage and Handling Requirements:
  - .1            Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2            Store and protect wire and box connectors from nicks, scratches, and blemishes.
  - .3            Replace defective or damaged materials with new.

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**Part 2 Products**

**2.1 MATERIALS**

- .1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper conductors as required.
- .2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 NEMA to consist of:
  - .1 Connector body and stud clamp for stranded copper conductors.
  - .2 Clamp for stranded copper conductors.
  - .3 Stud clamp bolts.
  - .4 Bolts for copper conductors bar.
  - .5 Sized for conductors tubes bars as indicated.
- .4 Clamps or connectors for armoured cable, TECK cable, flexible conduit as required to: CAN/CSA-C22.2 No.18.
- .5 Joints require in connecting all wiring up to and including #8 are to be made using twist-on connectors.
- .6 Joints for all other wiring shall be made using colour-keyed compression type connectors followed by a layer of CSA approved vinyl plastic tape.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2 INSTALLATION**

- .1 Remove insulation carefully from ends of conductors cables and:
  - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.
  - .2 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
  - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2 NEMA.

**3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1    Section 26 05 00 – Common Work Results – Electrical.
- .2    Section 26 05 20 – Wires and Cables (0-1000V).
- .3    Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

**1.2                REFERENCES**

- .1    CSA C22.2 No .0.3-09, Test Methods for Electrical Wires and Cables.
- .2    CAN/CSA-C22.2 No. 131-M89 (R2004), Type TECK 90 Cable Latest Edition.

**1.3                PRODUCT DATA**

- .1    Provide product data in accordance with Section 01 33 00 - Submittal Procedures.
  - .1    Provide installation instructions
  - .2    Provide manufacturer test data for fire rated cabling.

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1    Packaging Waste Management: remove for reuse and return by manufacturer of pallets crates padding packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2            Products**

**2.1                BUILDING WIRES**

- .1    Conductors: solid for #10 AWG and smaller; stranded for #8 AWG and larger. Minimum size: #12 AWG.
- .2    Conductors: size as indicated, with 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.
- .3    Conductors: all wiring shall be copper.
- .4    Neutral conductor insulated for 600V shall be continuous with no fuses, switches, or breaks of any kind.
- .5    Wiring requirements for specialized systems such as fire alarm etc. are indicated in the respective specification sections or on drawings.
- .6    The voltage drop shall in no case exceed 2% of the line volts for branch circuits.
- .7    Voltage drop shall be calculated based on 80% of the circuit breaker current rating for all branch circuits unless noted otherwise.

- .8 Branch circuit conductor sizes specified on drawings are the minimum required. Upsize branch circuit conductor sizes as required so that the voltage drop is less than the maximum value permitted.
- .9 AC90 cabling shall not be permitted to be installed.

## **2.2 TECK 90 CABLE**

- .1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Conductors:
  - .1 Grounding conductor: copper or as indicated.
  - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
  - .1 Cross-linked polyethylene XLPE.
  - .2 Rating: 600V or as indicated.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum.
- .6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.
- .7 Fastenings:
  - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
  - .2 Channel type supports for two or more cables at 900 mm centers.
  - .3 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
  - .1 Watertight, approved for TECK cable.

## **2.3 2-HOUR FIRE RATED CABLE**

- .1 Mineral Insulated Cable:
  - .1 Conductors: solid bare soft-annealed copper, size as indicated.
  - .2 Insulation: compressed powdered magnesium oxide to form compact homogeneous mass throughout entire length of cable.
  - .3 Overall covering: annealed seamless copper sheath, Type MI rated 600V, 250°C for twisted pair cable.
  - .4 Connectors: manufacturers for use with cable specified.
  - .5 Termination kits: manufactured for use with cable specified. Use “Quick Termination Kits” with RW90 stranded copper wire on single conductor cables.
  - .6 Use mineral insulated twisted pair, and shielded twisted pair communication cable, for fire alarm speakers and fireman telephone wiring.
  - .7 The term “jacketed” used on plans shall indicate the product is supplied from factory with a Low-smoke, Zero-halogen polyolefin coating.

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**Part 3 Execution**

**3.1 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

**3.2 GENERAL CABLE INSTALLATION**

- .1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .3 Conductor length for parallel feeders to be identical.
- .4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

**3.3 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings where RW90 cable type is noted
  - .2 AC90 shall be permitted for light fixture drops or equipment connections.
  - .3 Use vibration proof expanding spring wire connectors for No. 10 and smaller.

**3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)**

- .1 Group cables wherever possible on channels.
- .2 Install cable exposed concealed, securely supported by straps or hangers.

**3.5 INSTALLATION OF 2HR FIRE RATED CABLE**

- .1 Installation of mineral insulated cables:
  - .1 Run cable concealed, securely supported by straps.
  - .2 Support 2 hour fire rated cables at 1m intervals.
  - .3 Make cable terminations by using factory-made kits. "Quick Termination Kits" shall be used on single conductor cable.
  - .4 At cable terminations use thermoplastic sleeving over bare conductors.

- .5 Do not splice cables.
- .6 Protect unterminated cable ends so as to prevent moisture from entering cable.
- .7 Prior to energizing cables, perform megger test to ensure that cables meet manufacturer's requirements.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 26 05 00 - Common Work Results for Electrical

**1.2                REFERENCES**

- .1            American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)
  - .1            ANSI/IEEE 837-2014, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Product Data:
  - .1            Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4                CLOSEOUT SUBMITTALS**

- .1            Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2            Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

**1.5                DELIVERY, STORAGE AND HANDLING**

- .1            Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's instructions.
- .2            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3            Storage and Handling Requirements:
  - .1            Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2            Store and protect grounding equipment from nicks, scratches, and blemishes.
  - .3            Replace defective or damaged materials with new.
- .4            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan

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**Part 2 Products**

**2.1 EQUIPMENT**

- .1 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.
- .2 Insulated grounding conductors: green, copper conductors, size as indicated.
- .3 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1 Grounding and bonding bushings.
  - .2 Protective type clamps.
  - .3 Thermite welded type conductor connectors.
  - .4 Bonding jumpers, straps.

**2.2 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**2.3 INSTALLATION GENERAL**

- .1 Install complete permanent, continuous grounding system including, conductors, connectors, accessories. Run ground wire in conduit where indicated.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

**2.4 EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. transformers, switchgear, generators.

**2.5 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

**2.6 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 26 05 00 – Common Work Results for Electrical.

**1.2                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2        Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3        Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4        Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
- .5        Fold up metal banding, flatten and place in designated area for recycling.

**Part 2            Products**

**2.1                SUPPORT CHANNELS**

- .1        U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended set in poured concrete walls and ceilings.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Secure equipment to hollow solid masonry, tile and plaster surfaces with lead anchors nylon shields.
- .2        Secure equipment to poured concrete with expandable inserts.
- .3        Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4        Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5        Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6        Fasten exposed conduit or cables to building construction or support system using straps.
  - .1        One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
  - .2        Two-hole steel straps for conduits and cables larger than 50 mm.
  - .3        Beam clamps to secure conduit to exposed steel work.

- .7 Suspended support systems.
  - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
  - .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels at 1500 mm on centre spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

### **3.1 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

### **3.2 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 26 05 00 – Common Work Results for Electrical

**1.2                REFERENCES**

- .1            Canadian Standards Association (CSA International)
  - .1            CSA C22.1-18, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Product Data:
  - .1            Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3            Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
  - .1            Provide drawings stamped and signed by professional engineer registered or licensed in Province of Newfoundland, Canada.

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1            Waste Management and Disposal:
  - .1            Separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2            Products**

**2.1                JUNCTION AND PULL BOXES**

- .1            Construction: welded steel enclosure.
- .2            Covers Flush Mounted: 25 mm minimum extension all around.
- .3            Covers Surface Mounted: screw-on flat turned edge covers.

**Part 3            Execution**

**3.1                JUNCTION AND PULL BOXES INSTALLATION**

- .1            Install pull boxes in inconspicuous but accessible locations.
- .2            Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

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**3.2 IDENTIFICATION**

- .1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.
- .2 Identification Labels: size 2 indicating system name, voltage and phase or as indicated.

**3.1 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

**3.2 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 26 05 00 – Common Work Results for Electrical

**1.2                REFERENCES**

- .1            Canadian Standards Association (CSA International)
  - .1            CSA C22.1-15, Canadian Electrical Code, Part 1, 20th Edition.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1            Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2            Waste Management and Disposal:
  - .1            Separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2            Products**

**2.1                OUTLET AND CONDUIT BOXES GENERAL**

- .1            Size boxes in accordance with CSA C22.1.
- .2            102 mm square or larger outlet boxes as required.
- .3            Gang boxes where wiring devices are grouped.
- .4            Blank cover plates for boxes without wiring devices.
- .5            347 V outlet boxes for 347 V switching devices.
- .6            Combination boxes with barriers where outlets for more than one system are grouped.

**2.2                GALVANIZED STEEL OUTLET BOXES**

- .1            One-piece electro-galvanized construction.
- .2            Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .3            Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .4            102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .5            Extension and plaster rings for flush mounting devices in finished plaster walls.

**2.3 FITTINGS - GENERAL**

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 35mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

**3.1 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

**3.2 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**hEND OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 26 05 00 Common Work Results for Electrical.

**1.2                REFERENCES**

- .1            Canadian Standards Association (CSA International)
  - .1            CAN/CSA C22.2 No. 18.2-06(R2016), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
  - .2            CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.
  - .3            CSA C22.2 No. 56-13, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .4            CSA C22.2 No. 83-M1985(R2013), Electrical Metallic Tubing.
  - .5            CSA C22.2 No. 211.2-06(R201), Rigid PVC (Unplasticized) Conduit.
  - .6            CAN/CSA C22.2 No. 227.3-05(R2010), Non-metallic Mechanical Protection Tubing (NMPT), A National Standard of Canada.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Product data: submit manufacturer's printed product literature, specifications and datasheets.
  - .1            Submit cable manufacturing data.
- .3            Quality assurance submittals:
  - .1            Test reports: submit certified test reports.
  - .2            Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .3            Instructions: submit manufacturer's installation instructions.

**1.4                WASTE MANAGEMENT AND DISPOSAL**

- .1            Separate waste materials for reuse recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2            Place materials defined as hazardous or toxic waste in designated containers.
- .3            Ensure emptied containers are sealed and stored safely for disposal away from children.

**Part 2            Products**

**2.1                CONDUITS**

- .1            Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

- .2 Flexible metal conduit and liquid-tight flexible conduit, complete with anti-short bushings: to CSA C22.2 No. 56-04, steel and liquid-tight flexible metal.

## **2.2 CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 53 mm and smaller.
  - .1 Two hole steel straps for conduits larger than 53 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m on centre.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

## **2.3 CONDUIT FITTINGS**

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit. To CAN/CSA C22.2 No. 18, Manufactured for use with conduit specified.
- .2 Rain tight EMT connectors shall be used on vertical sections of conduit runs where terminating into tops of electrical equipment incorporating drip shields or hoods.
- .3 Ensure factory "ells" where 90 degrees bends for 27 mm and larger conduits.
- .4 Fittings: Use steel set screw connectors and fittings for EMT. Coating: same as conduit.
- .5 Connectors for flexible conduit shall be set screw galvanized steel.
- .6 Connectors for liquid tight flexible conduit shall be water tight, compression type galvanized steel.
- .7 Threaded plastic or metal bushings to be installed on all EMT connectors sizes 35 mm and larger.
- .8 Connections for liquid tight flexible conduit shall be watertight compression type galvanized steel

## **2.4 FISH CORD**

- .1 Polypropylene.

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### **3.2 INSTALLATION**

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms in unfinished areas.

- .3 Use electrical metallic tubing (EMT) for surface conduits.
- .4 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without prewired outlet box, connection to surface or recessed fluorescent fixtures and work in movable metal partitions.
- .5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .6 Minimum conduit size for lighting and power circuits: 21 mm.
- .7 Bend conduit cold:
  - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .8 Mechanically bend steel conduit over 19 mm diameter.
- .9 Install fish cord in empty conduits.
- .10 Remove and replace blocked conduit sections.
  - .1 Do not use liquids to clean out conduits.
- .11 Dry conduits out before installing wire.

### **3.3 SURFACE CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

### **3.4 CONCEALED CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

### **3.5 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

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**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

**1.2 REFERENCES**

- .1 CSA International
  - .1 CAN/CSA-C22.2 No.47-13, Air-Cooled Transformers (Dry Type).
  - .2 CSA C9-02(R2016), Dry-Type Transformers.
  - .3 CAN/CSA-C802.2-06, Minimum Efficiency Values for Dry Type Transformers.
- .2 National Electrical Manufacturers Association (NEMA)

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

**1.4 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 DESIGN DESCRIPTION**

- .1 Existing Siemens transformer.
  - .1 Provide wall mounted brackets for existing 15KVA transformer.

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**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for dry type transformers installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2 INSTALLATION**

- .1 Mount dry type transformers up to 75 kVA as indicated.
- .2 Ensure adequate clearance around transformer for ventilation.
- .3 Install transformers in level upright position.
- .4 Make primary and secondary connections in accordance with wiring diagram.
- .5 Energize transformers after installation is complete.

**3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**3.4 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by dry type transformers installation.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 26 05 00 Common Work Results for Electrical.

**1.2                REFERENCES**

- .1            CSA International
  - .1            CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.
  - .2            CAN/CSA C22.2 No.42.1-00(R2009), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
  - .3            CSA C22.2 No.55-M1986(R2012), Special Use Switches.
  - .4            CSA C22.2 No.111-10(R2015), General-Use Snap Switches (Bi-national standard, with UL 20).

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Product Data:
  - .1            Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4                CLOSEOUT SUBMITTALS**

- .1            Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2            Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

**1.5                DELIVERY, STORAGE AND HANDLING**

- .1            Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3            Storage and Handling Requirements:
  - .1            Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2            Store and protect wiring devices from nicks, scratches, and blemishes.
  - .3            Replace defective or damaged materials with new.

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**Part 2            Products**

**2.1                SWITCHES**

- .1    20A, 120 V, single pole, three-way and four-way switches to: CSA C22.2 No.55 CSA C22.2 No.111.
- .2    Manually-operated general purpose AC switches with following features:
  - .1    Terminal holes approved for No. 10 AWG wire.
  - .2    Silver alloy contacts.
  - .3    Urea or melamine moulding for parts subject to carbon tracking.
  - .4    Suitable for back and side wiring.
  - .5    White toggle.
- .3    Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads heating loads.
- .4    Switches of one manufacturer throughout project.

**2.2                RECEPTACLES**

- .1    Duplex receptacles, CSA type 5-20 R, 125 V, 20 A, U ground, to: CSA C22.2 No.42 with following features:
  - .1    White urea moulded housing.
  - .2    Suitable for No. 10 AWG for back and side wiring.
  - .3    Break-off links for use as split receptacles.
  - .4    Eight back wired entrances, four side wiring screws.
  - .5    Triple wipe contacts and riveted grounding contacts.
- .2    Ground fault circuit interrupter as indicated
- .3    Receptacles of one manufacturer throughout project.

**2.3                COVER PLATES**

- .1    Cover plates for wiring devices to: CSA C22.2 No.42.1.
- .2    Unbreakable, nylon thermoplastic cover plates.
- .3    Label all cover plates with circuit ID and use.

**2.4                SOURCE QUALITY CONTROL**

- .1    Cover plates from one manufacturer throughout project.

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**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2 INSTALLATION**

- .1 Switches:
  - .1 Install single throw switches with handle in "UP" position when switch closed.
  - .2 Install switches in gang type outlet box when more than one switch is required in one location.
  - .3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results for Electrical or as indicated.
- .2 Receptacles:
  - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
  - .2 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results for Electrical or as indicated.
- .3 Cover plates:
  - .1 Install suitable common cover plates where wiring devices are grouped.
  - .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

**3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**3.4 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .3 Repair damage to adjacent materials caused by wiring device installation.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 00 - Common Work Results for Electrical.

**1.2 REFERENCES**

- .1 CSA International
  - .1 CSA C22.2 No. 5-16, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Include time-current characteristic curves for breakers with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.
- .4 Certificates:
  - .1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 1 copy of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.
    - .1 Production certificate of origin must be submitted to Departmental Representative for approval.
  - .2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.
  - .3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.
  - .4 Production certificate of origin must contain:
    - .1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.
    - .2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.
    - .3 Contractor's name and address and person responsible for project.

- .4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.
- .5 Name and address of building where circuit breakers will be installed:
  - .1 Project title:
  - .2 End user's reference number:
  - .3 List of circuit breakers:

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store circuit breakers off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect circuit breakers from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

### **Part 2 Products**

#### **2.1 BREAKERS GENERAL**

- .1 Moulded-case circuit breakers, Circuit breakers, ground-fault circuit-interrupters: to CSA C22.2 No. 5
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Circuit breakers interrupting rating to match existing.
- .5 Refer to specification section 26 05 00 – Common Work Results for Electrical for breaker coordination requirements.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 INSTALLATION**

- .1 Install circuit breakers as indicated.

### **3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 26 05 00 - Common Work Results for Electrical.

**1.2                REFERENCES**

- .1            CSA Group
  - .1            CAN/CSA-C22.2 No.4-16, Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMX-J-162-2004 and UL 98).
  - .2            CSA C22.2 No.39-13, Fuse holder Assemblies.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Product Data:
  - .1            Submit manufacturer's instructions, printed product literature and data sheets for disconnect switches - fused and non-fused and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1            Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3            Storage and Handling Requirements:
  - .1            Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2            Store and protect disconnect switches - fused and non-fused from nicks, scratches, and blemishes.
  - .3            Replace defective or damaged materials with new.

**Part 2            Products**

**2.1                DISCONNECT SWITCHES**

- .1            Non-fusible, Horsepower rated disconnect switch in CSA enclosure, to CAN/CSA-C22.2, No.4 size as indicated.
- .2            Provision for padlocking in on-off off switch position by 3 locks.
- .3            Mechanically interlocked door to prevent opening when handle in ON position.
- .4            Fuses: size as indicated, type manufacturers recommendations unless otherwise indicated.

- .5 Quick-make, quick-break action.
- .6 ON-OFF switch position indication on switch enclosure cover.

## **2.2 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for disconnect switches - fused and non-fused installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 INSTALLATION**

- .1 Install disconnect switches.

### **3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 26 05 00 - Common Work Results for Electrical.

**1.2                REFERENCES**

- .1            American Petroleum Institute (API)
  - .1            API Std. 650-2007(A2008), Welded Steel Tanks for Oil Storage 11th Edition.
- .2            Canadian General Standards Board (CGSB)
  - .1            CAN/CGSB-3.6-2010, Amend. 2, Regular Sulphur Diesel Fuel.
- .3            Canadian Environmental Protection Act (CEPA)
  - .1            CCME PN 1326-2008, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems for Petroleum Products and Allied Petroleum Products.
- .4            CSA International
  - .1            CSA-B139-09, Installation Code for Oil Burning Equipment.
- .5            International Organization for Standardization (ISO)
  - .1            ISO 3046-1-2002, Reciprocating Internal Combustion Engines - Performance - Part 1: Declarations of Power, Fuel and Lubricating Oil Consumptions, and Test Methods - Additional requirements for engines for general use.
- .6            National Electrical Manufacturers Association (NEMA)
  - .1            NEMA MG 1-2016, Motors and Generators.
- .7            Underwriters' Laboratories of Canada (ULC)
  - .1            CAN/ULC-S601-14 Standard for Shop Fabricated Steel Aboveground Horizontal Tanks for Flammable and Combustible Liquids.
  - .2            ULC-S603-14, Standard for Steel Underground Tanks for Flammable and Combustible Liquids.

**1.3                DELIVERY, STORAGE AND HANDLING**

- .1            Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3            Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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**1.4 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include:
  - .1 Recommended manufacturer oil type and quantity for one oil change.
  - .2 1 fuel filter replacement elements.
  - .3 1 lube oil filter replacement elements.
  - .4 1 air cleaner filter elements.

**Part 2 Products**

**2.1 SYSTEM DESCRIPTION**

- .1 The diesel generator is an existing Caterpillar rated at 600kW, 347V/600V, 3PH, 4W.
- .2 Contractor is responsible to test the generator and provide all cabling, load bank, guard dog and ancillaries as required to carry out the testing requirements as outlined in Part 3.
- .3 After completion of generator testing, contractor is responsible to provide labour and materials to change the oil, oil filter, fuel filter and air filter.

**Part 3 Execution**

**3.1 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Notify Consultant and Departmental Representative 15 working days in advance of test date. All testing to be completed in presence of Engineer.
- .3 Provide fuel for testing and leave full tanks on acceptance.
- .4 Demonstrate:
  - .1 Unit start, transfer to load, retransfer to normal power, unit shut down, on "Automatic" control.
  - .2 Unit start and shut down on "Manual" control
  - .3 Unit start and transfer on "Test" control.
  - .4 Unit start on "Engine start" control.
  - .5 Operation of manual bypass switch.
  - .6 Operation of automatic alarms and shut down devices.
  - .7 Overspeed.
  - .8 Alternator over voltage.
  - .9 Low lube oil pressure.
- .5 Run unit on load for minimum period of 4 hours to show 100% load carrying ability, stability of voltage and frequency, and satisfactory performance of dampers in ventilating system to provide adequate engine cooling.

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- .6 Next install continuous strip chart recorders to record frequency and voltage variations during load switching procedures. Each load change delayed until steady state conditions exist. Switching increments to include:
    - .1 No load to full load to no load.
    - .2 No load to 70% load to no load.
    - .3 No load to 20% load to no load.
    - .4 20% load to 40% load to no load.
    - .5 40% load to 60% load to no load.
    - .6 60% load to 80% load to no load.
  - .7 At end of test run, check battery voltage to demonstrate battery charger has returned battery to fully charged state.
  - .8 All testing shall be as per the requirements of CSA C282-09.
  - .9 Strip chart test and all generator commissioning reports shall be provided to the Engineer for review.

### **3.2 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal

### **3.3 MAINTENANCE - CLEARANCES**

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and CSA-B139.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 26 05 00 Common Work Results for Electrical.

**1.2                REFERENCES**

- .1            CSA International
  - .1            CSA C22.2 No.141-15, Emergency Lighting Equipment.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Product Data:
  - .1            Submit manufacturer's instructions, printed product literature and data sheets for emergency lighting and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4                CLOSEOUT SUBMITTALS**

- .1            Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2            Operation and Maintenance Data: submit operation and maintenance data for emergency lighting for incorporation into manual.

**1.5                DELIVERY, STORAGE AND HANDLING**

- .1            Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3            Storage and Handling Requirements:
  - .1            Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2            Store and protect emergency lighting]from nicks, scratches, and blemishes.
  - .3            Replace defective or damaged materials with new.

**1.6                WARRANTY**

- .1            For batteries in this Section 26 52 00 - Emergency Lighting, 12 months warranty period is extended to 120 months.

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**Part 2            Products**

**2.1                EQUIPMENT**

- .1    Emergency lighting equipment: to CSA C22.2 No.141.
- .2    Supply voltage: 120/347 VAC, field selectable.
- .3    Output voltage: 12 V DC.
- .4    Operating time: 120 minutes.
- .5    Battery: 12V valve regulated lead acid (VRLA).
- .6    Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.
- .7    Solid state transfer circuit.
- .8    Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .9    Signal lights: solid state, for 'AC Power ON' and 'High Charge'.
- .10   Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, size and output as per luminaire schedule.
- .11   Cabinet: suitable for direct mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.
- .12   Housing: fully gasketed reinforced polycarbonate housing with stainless steel hardware, NEMA 4X rated, white finish.
- .13   Auxiliary equipment:
  - .1      Self-diagnostic
  - .2      Test switch.
  - .3      Battery disconnect device.
  - .4      AC input and DC output terminal blocks inside cabinet.
- .14   Acceptable Materials:
  - .1      As indicated on luminaire schedule

**2.2                WIRING OF REMOTE HEADS**

- .1    Conduit: type, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2    Conductors: type in accordance with Section 26 05 21 - Wires and Cables (0-1000 V), sized as indicated.

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**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for emergency lighting installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2 INSTALLATION**

- .1 Install unit equipment and remote mounted fixtures.
- .2 Direct heads.
- .3 Connect exit lights to unit equipment.

**3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**3.4 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by emergency lighting installation.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 26 05 00 Common Work Results for Electrical.

**1.2                REFERENCES**

- .1            Canadian Standards Association (CSA International)
  - .1            CSA C22.2 No.141-15, Unit Equipment for Emergency Lighting.
  - .2            CSA C860-11(R2016), Performance of Internally-Lighted Exit Signs.
- .2            National Fire Protection Association (NFPA)
  - .1            NFPA 101-2015, Life Safety Code.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Product Data:
  - .1            Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3            Quality Assurance Submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  - .1            Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

**1.4                WASTE MANAGEMENT AND DISPOSAL**

- .1            Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2            Products**

**2.1                SELF-POWERED UNITS**

- .1            Exit lights: to CSA C22.2 No.141 and CSA C860.
- .2            Housing: Extruded aluminum construction, white powder coat finish.
- .3            Style and Lamping: "LED Pictogram" Refer to luminaire schedule.
- .4            Mounting: Wall or ceiling mounted as indicated by drawings.
- .5            Faceplates: Single or double faced with Green Running Man Pictogram.
- .6            Operation: over 100,000 hours of continuous operation without relamping LED.
- .7            Supply voltage: 120/347 VAC, field selectable.

- .8 Output voltage: 12 VDC.
- .9 Operating time: 120 minutes minimum.
- .10 Recharge time: 12 hours
- .11 Battery: nickel cadmium, sealed, maintenance free.
- .12 Charger: solid state, voltage/current regulated, inverse temperature compensated, short circuit protected, with regulated output of plus or minus 0.01 V for plus or minus 10% V input variation.
- .13 Solid state transfer circuit.
- .14 Signal lights: solid state, for 'AC Power ON' 'High Charge' condition.
- .15 Mounting: suitable for universal mounting directly on junction box and c/w knockouts for conduit.
  - .1 Removable or hinged front panel for easy access to batteries.
- .16 Auxiliary equipment:
  - .1 Self-Diagnostic
  - .2 Lamp disconnect switch.
  - .3 Test switch.
  - .4 AC/DC output terminal blocks inside cabinet.
- .17 Acceptable Materials:
  - .1 As indicated on luminaire schedule.

### **Part 3 Execution**

#### **3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

#### **3.2 INSTALLATION**

- .1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.
- .2 Connect fixtures to exit light circuits.
- .3 Connect emergency lamp sockets to emergency circuits.
- .4 Ensure that exit light circuit breaker is locked in on position.

#### **3.3 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.

- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**