

**Part 1 General**

**1.1 GENERAL**

- .1 These specifications are based on the National Master Specifications (NMS). However, it has been adapted to take project features into consideration.
- .2 In these sections, drawings and specifications refer to construction drawings and specifications issued with Contract documents.
- .3 This section includes common requirements for all sections of Division 26 and is a complement to all Contract clauses, to all general clauses, and to all other applicable clauses of architectural, structural and mechanical specifications.
- .4 These specifications do not contain necessarily detailed specifications for the design, for construction, or for all equipment parts and components, and installations. If not available, the Contractor shall observe generally accepted techniques and manufacturer's recommendations.
- .5 All discrepancies between drawings and general specs or other trades with electrical drawings and specs shall be brought to the attention of the Ministerial Representative before submission close date. The later shall provide supplementary information as necessary by addendum.
- .6 These electrical specifications apply to the electrical contractor as well as other contractors. Construction manager shall assume general responsibility and good coordination of his works and coordination with other contractors.
- .7 All systems shall be complete, fully operational and containing all equipment and accessories required to deliver at completion of work fully functional places in conformity to applicable codes and standards.

**1.2 RELATED SECTIONS**

- .1 01 33 00 - Submittal Procedures.
- .2 01352906 - Health and Safety Requirements.
- .3 014500 - Quality Control.
- .4 016100 - Common Product Requirements.
- .5 017411 - Cleaning.
- .6 017421 - Construction/Demolition Waste Management And Disposal.
- .7 26 05 30 – Fastenings and Supports.

**1.3 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-07, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.

- .2 CAN3-C235-83(R2006), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
  - .1 IEEE SP1122, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

#### **1.4 DEFINITIONS**

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

#### **1.5 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.

#### **1.6 SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for review fire alarm riser diagram, plan and zoning of building in glazed frames at fire alarm control panel and annunciator.
- .3 Shop drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, 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 If changes are required, notify Engineer of these changes before they are made.
- .4 Quality Control: in accordance with Section 01 45 00 - Quality Control.
  - .1 Provide CSA certified equipment and material.
  - .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.

- .3 Submit test results of installed electrical systems and instrumentation.
- .4 Permits and fees: in accordance with General Conditions of contract.
- .5 Submit, 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 Ministerial Representative.

## **1.7 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.
  - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
  - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 Site Meetings:
  - .1 Site Meetings: as part of Manufacturer's Field Services described in Part 3 - FIELD QUALITY CONTROL, in appropriate NMS, schedule site visits, to review Work, at stages listed.
    - .1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
    - .2 Twice during progress of Work at 25% and 60% complete.
    - .3 Upon completion of Work, after cleaning is carried out.
- .4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## **1.8 DELIVERY, STORAGE AND HANDLING**

- .1 Material Delivery Schedule: provide Ministerial Representative with schedule within 2 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **1.9 SYSTEM STARTUP**

- .1 Instruct Ministerial Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

## **1.10 OPERATING INSTRUCTIONS**

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
  - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
  - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
  - .3 Safety precautions.
  - .4 Procedures to be followed in event of equipment failure.
  - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.

## **Part 2 Products**

### **2.1 MATERIALS AND EQUIPMENT**

- .1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

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

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit: completely done by control division (Mechanical).

### **2.3 WARNING SIGNS**

- .1 Warning Signs: in accordance with requirements of inspection authorities and Ministerial Representative.
- .2 Porcelain enamel signs, minimum size 175 x 250 mm.

## **2.4 WIRING TERMINATIONS**

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for copper or conductors.

## **2.5 EQUIPMENT IDENTIFICATION**

- .1 Identify electrical equipment with nameplates and labels as follows:
  - .1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, lettering accurately aligned and engraved into core, mechanically attached with self tapping screws.

- .1 Nameplate's color:

	Front	Letters
Normal network	Black	Whites
Emergency network	Black	Reds
Fire alarm	Black	Reds

- .2 Sizes as follows:

### **NAMEPLATE SIZES**

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Ministerial Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate.
- .5 Nameplates for terminal cabinets, pull boxes and junction boxes to indicate system and/or voltage characteristics.
- .6 Equipment nameplate : seize 3 with inscription as indicated and instruction of ministerial Representative.
- .7 Disconnects, starters and contactors: indicate equipment being controlled, the number of the disconnect, starter or contactor, the number of the feeding panel with the respective circuits.
- .8 Transformers: indicate capacity, primary and secondary voltages.
- .9 Identify the receptacles and lighting switches with plastic pressure sensitive label (Brother P-touch), indicating the number of the feeding panel with the respective circuits. The labels must be whites with black letters.
- .10 Make the identification of each circuit in the modified panels and new panels in new dactylographic tables. Panel dactylographic tables to be approved by Ministerial Representative prior to manufacture and/or installation.

## **2.6 WIRING IDENTIFICATION**

- .1 Identify wiring with permanent indelible identifying markings, numbered plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

## **2.7 CONDUIT AND CABLE IDENTIFICATION**

- .1 Colour code conduits and boxes. Colour code to be approved by Ministerial Representative prior installation.
- .2 Paint all the edge of junction and pull boxes respecting the colour code, but not the cover.
- .3 Identify using a big marker pen with indelible ink on the cover plate, the feeding source and the number of the circuits of all the wiring passing through junction and pull boxes, only when they are located in unfinished spaces.
- .4 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .5 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Other Security Systems	Red	Yellow

## **2.8 FINISHES**

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
  - .1 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Do complete installation in accordance with Construction Code of Quebec, Chapter V-Electricity, except where specified otherwise.

### **3.2 NAMEPLATES AND LABELS**

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

### **3.3 CONDUIT AND CABLE INSTALLATION**

- .1 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .2 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

### **3.4 FIRE-PROOFING**

- .1 When conduits or cables cross fire-rated walls or slabs, ensure fire and smoke tightness by using 3M products CP25, 303, FS195, CS95 and sealing kits of 7902 and 7904 series. Installation shall be executed according to CAN2-19.13 standard and to manufacturer's recommendations.

### **3.5 SUPPORTS AND TIES**

- .1 Install required ties and supports according to the requirements of each type of equipment, conduit, cable and others, and according to manufacturer's recommendations.
- .2 Each equipment, apparatus, conduit, cable and other shall be supported independently. The use of other supports or ties installed by other trades for other equipment is prohibited.
- .3 The use of bracing strings, perforated sheets, "Ty-Rap" nylon ties as ties or supports is prohibited.

### **3.6 SEISMIC PROTECTION**

- .1 Ensure seismic protection for electrical installations in accordance with Section 26 05 30 – Seismic Restraint Systems (SRS).

### **3.7 LOCATION OF OUTLETS**

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors.
  - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

### **3.8 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 and dimmers: 1200 mm.
  - .2 Wall receptacles:
    - .1 General: 400 mm.
    - .2 Above top of continuous baseboard heater: 200 mm.
    - .3 Above top of counters or counter splash backs: 175 mm.
    - .4 In mechanical rooms: 1400 mm.
  - .3 Panelboards: as required by Code or as indicated.
  - .4 Telephone and interphone outlets: 400 mm.
  - .5 Fire alarm stations: 1200 mm.
  - .6 Fire alarm bells: 2100 mm.
  - .7 Door bell pushbuttons: 1200 mm.

### **3.9 OPENINGS**

- .1 The Electrical contractor is responsible to make all the necessary openings in the ceilings and walls. All the existing ceilings and walls, damaged by the installation of equipments or cables, must be repaired respecting the existing finishes.
- .2 The Electrical contractor is responsible to repair all openings due to the dismantling of existing equipments, respecting the existing finishes.

### **3.10 FIELD QUALITY CONTROL**

- .1 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 - 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.
- .2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
  - .1 Circuits originating from branch distribution panels.
  - .2 Lighting and its control.
  - .3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
  - .4 Systems: fire alarm system.
  - .5 Insulation resistance testing:
    - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.



- .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
- .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Ministerial Representative.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
- .6 Single line diagrams:
  - .1 The electrical contractor must do the update for single line diagrams on both copies of the building. Coordinate with operations team to access the electrical room. The update of the electronic copy of the single line diagram will be done by the consultant.
  - .2 Provide equipment identification in electricity with the nomenclature used for the single line diagrams.

### **3.11 CLEANING**

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

**END OF SECTION**



<b>Part</b>	<b>General</b>
<b>1.1</b>	<b>GENERAL</b>
.1	The work includes, but is not limited to, the supply, manufacture, design, if necessary, set-up, internal wiring, installation, connections, inspections, painting, factory testing, provision of labour, handling, storage, anchoring, levelling, transportation, delivery, assembly, disassembly, dismantling, site testing and warranty for all equipment and components.
.2	Drawings and specifications are complementary. What is required by one is required by both and is included in the submission documents.
.3	All electrical equipment must be heavy-duty industrial type with minimum enclosures in accordance with the identification given in Scope of Work below.
.4	Unless otherwise indicated, throughout the plant pumping stations use EMT (electrical metallic tube) conduits, surface-mounted or in the entreplafond. For exterior and surface-mounted conduits use threaded galvanized rigid steel.
.5	Use RW-90 XLPE power cables between electrical equipment such as MCC, panels, disconnect switches, pumps, ventilators, etc., use VFD cables for loads with variable speed drives; install in conduits.
.6	Clearly identify equipment and conductors. Identify conductors with the same colour as the phase where they originate.
.7	Install a suitably sized, green, insulated grounding conductor in all conduits, including metal conduits, to ensure a continuous ground.
.8	Install all green grounding conductors, insulated or exposed, in electrical conduits.
.9	All materials shall be new, highest quality and CSA approved.
.10	Install equipment so as to facilitate access, maintenance, disassembly, repair, etc.
.11	Seal all openings used for conduits or for fastening and anchoring equipment.
.12	Adjust and test equipment to ensure proper operation.
.13	Locations of equipment (including distribution equipment such as panels, MCC, VFD, etc. and services such as lighting, outlets, etc.) may be changed without additional cost provided that the move does not exceed 5 m and that notice was given prior to installation.
.14	Adequately size branch feeder and main feeder cables for services and power such as pumps, ventilators, outlets, lighting, heating, etc., to limit voltage drops to 3% of rated voltage. Following installation of the equipment, coordinate and determine, on site, final routing of main feeder cables for the various loads and motive-power circuits.
.15	Equipment dimensions not to exceed those shown in the drawings.

## **1.2 GENERALS INFORMATIONS OF WORKS**

- .1 The work includes, but is not limited to, supplying, installing and connecting the systems and equipment listed below:
  - .1 Multi-speed starters in enclosures;
  - .2 Disconnect switches with or without fuse;
  - .3 Junction boxes and panelboards;
  - .4 Installation and connection of all electrical equipment provided by other disciplines;
  - .5 Grounding system equipment and related hardware;
  - .6 Nameplates;
  - .7 Coordination with other building disciplines;
  - .8 Testing and commissioning including manufacturers' start-up test certificates;
  - .9 Hardware and accessories for seismic installation of equipment;
  - .10 Anti-spill bases for all equipment;
  - .11 Fire protection for all openings and cut-outs; for recommended fire protection product, see specifications in the architecture discipline clauses;
  - .12 Power cables including VFD cables, fittings and connectors;
  - .13 Conduits including connectors and accessories;
  - .14 Connection and interconnection of electrical equipment including motor control centers, VFD starters, etc., to automation and process control panels to ensure proper operation of process systems; provide wiring and conduits in accordance with the requirements and recommendations of the automation and process discipline; refer to PID diagrams and sequence of operation of the automation and process discipline; closely coordinate this work with the automation and process discipline;
  - .15 Configuration and Programming of operating and control parameters of new electrical equipment for automation and process panels and for the plant's central control system; coordinate this work with the automation and process discipline;
  - .16 Storage battery units.
- .2 Identification:
  - .1 When choosing equipment and materials suited to the location and environmental conditions, consider the following descriptions:
    - .1 Pumping station: damp environment.
  - .2 "Damp" means the presence of humidity or water on the walls while "corrosive" indicates permanent or potential presence of H<sub>2</sub>S or other chemicals.
  - .3 All electrical equipment must be approved for installation in the locations referred to above: EEMAC 3 for indoor installation.

**END OF SECTION**

## **Part1 -General**

### **1.1 DEMOLITION**

- .1 Remove all existing electrical equipments indicated on the drawings. This equipment must be removed in appropriate time.
- .2 The supplies arteries of existing to be dismantled must be removed on all the length enter the load up to the source supply including conduit and cabling.

### **1.2 EXISTING EQUIPMENTS**

- .1 Means all existing equipment or components existing materials relevant to the existing electrical installations at the time of signing the contract associated with this specifications and drawings related thereto.
- .2 All existing equipment to remove:
  - .1 To be completely removed from its supply point to its point of use, unless indicated in drawing.
  - .2 Becomes the property of the Contractor when the owner does not recover. The Contractor shall dispose promptly.
- .3 All existing equipment to remove and relocate:
  - .1 To be relocated to a location specified in the new drawings.
  - .2 Where indicated in drawings, wiring of an existing unit to remove and relocate may be reused in whole or in part if the wiring is in excellent condition. However, it must respect the existing function of the wiring by giving it the same function.
- .4 Where existing fixtures are relocated, they must be with new lamps; fixture having any defective ballast, lenses broken and otherwise damage, must be returned in perfect condition with the appearance of a new device.

### **1.3 CONTINUITY OF ELECTRIC SERVICES**

- .1 Ensure the full continuity of electrical services to building occupants during and after construction.
- .2 Where changes to the existing electrical installation affect areas adjacent to works, supply and install conduits, conductors, equipment and accessories necessary for the permanent redistribution of services.

#### **1.4 INTERRUPTION OF POWER**

- .1 Interruptions of power supply should be minimized and shall be implemented in close coordination with the Ministerial Representative, who must be notified at least fifteen (15) working days in advance and recalled forty-eight (48) hours before work begins.
- .2 Interruptions of power supply must be planned and documented. The Contractor shall submit for approval a detailed description explaining the actions and work in each step. The duration of each operation must be adequately prepared to allow the Ministerial Representative to decide to proceed with the work.
- .3 In the event of an order-con from the Ministerial Representative, the Contractor shall provide the opportunity to restore power supply in operation in less than twenty (20) minutes.

#### **1.5 LOCATION OF THE EXISTING SERVICE**

- .1 The contractor has to hold the service of a subcontractor specialized to locate all the buried existing service. A device for detection of cables and conduits must be used. All the costs engendered further to an interruption of service due to a drilling the service of which were not detected are chargeable to the contractor.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Section 26 05 00 - Common Work Results – Electrical.
- .3 Section 26 05 01 – Electricity - Generals Informations of Works.

**1.2 REFERENCES**

- .1 Execute all the works, respecting the effective edition of the Construction Code of Quebec.
- .2 Execute all the works, respecting the effective edition of each code or norm having jurisdiction, including but not limited to:
  - .1 Canadian Standards Association (CSA International)
    - .1 CAN/CSA-C22.2No.18- Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
    - .2 CSA C22.2No.65, Wire Connectors.
  - .2 National Electrical Manufacturers Association (NEMA).

**1.3 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 and corrugated cardboard, packaging material, in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused wiring materials from landfill to metal recycling facility as approved by Ministerial Representative.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

- .3 Bushing stud connectors: to consist of:
  - .1 Connector body and stud clamp for round copper conductors.
  - .2 Clamp for stranded copper conductors.
  - .3 Stud clamp bolts.
  - .4 Bolts for copper conductors.
  - .5 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable.

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Remove insulation carefully from ends of conductors 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 CSA C22.2No.65.
  - .2 Install fixture type connectors and tighten. Replace insulating cap.
  - .3 Install bushing stud connectors in accordance with NEMA.

**END OF SECTION**



**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1    Section 01 33 00 - Submittal Procedures.
- .2    Section 01 74 21 Construction/Demolition Waste Management and Disposal.
- .3    Section 26 05 00 - Common Work Results – Electrical.
- .4    Section 26 05 01 – Electricity - Generals Informations of Works.
- .5    Section 26 05 20 - Wire And Box Connectors 0-1000 V.
- .6    Section 26 05 43.01 - Installation Of Cables In Trenches And In Ducts.

**1.2            REFERENCES**

- .1    Execute all the works, respecting the effective edition of the Construction Code of Quebec.
- .2    Execute all the works, respecting the effective edition of each code or norm having jurisdiction, including but not limited to:
  - .1    Canadian Standards Association (CSA International)
    - .1    CSA C22.2, No. 0.3, Test Methods for Electrical Wires and Cables.
    - .2    CAN/CSA-C22.2, No. 131, Type TECK 90 Cable.
    - .3    CSA C22.2 N° 123-96.
    - .4    CSA C22.2 N° 174-M1984.
  - .2    UNDERWRITERS LABORATORIES OF CANADA (ULC)
    - .1    ULC-S139-00, Method of Fire Test for Evaluation of Integrity of Electrical Cables.

**1.3            PRODUCT DATA**

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

**1.4            DELIVERY, STORAGE AND HANDLING**

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

**1.5            DRAWINGS**

- .1    Conductors numbers and sizes are indicated on drawings. If not indicated, conform to Construction Code of Quebec, Chapter V- Electricity requirements with a minimum acceptable size of 12 AWG for copper conductors.
- .2    Not all cabling is indicated on drawings. Indicated cabling is represented schematically and is used to identify circuit number to use. Provide and install all required cabling.
- .3    Neutral conductor to be same size as phase conductor, unless specified otherwise.

**Part 2            Products**

**2.1            BUILDING WIRES**

- .1      Conductors: stranded for 10 AWG and larger.
- .2      Copper conductors: size as indicated, with 600 or 1000 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE.
- .3      Conductors: minimum acceptable size of 12 AWG.
- .4      Each circuit must have a grounding wire (Green Wire). EMT conduit is not acceptable for grounding.

**2.2            ARMOURED CABLES**

- .1      Conductors: insulated, copper, size as indicated.
- .2      Type: AC90.
- .3      Armour: interlocking type fabricated from aluminum strip.
- .4      Connectors: anti short connectors.

**2.3            TECK 90 CABLE**

- .1      Conductors:
  - .1      Grounding conductor: copper.
  - .2      Circuit conductors: copper, size as indicated.
- .2      Insulation:
  - .1      Cross-linked polyethylene XLPE, 1000 V.
- .3      Inner Jacket: polyvinyl chloride (PVC) material.
- .4      Armor: galvanized steel.
- .5      Overall covering: PVC, compliant to FT-4 flammability standards.
- .6      Fastenings:
  - .1      One (1) hole aluminum straps to secure surface cables 53 mm and smaller. Two (2) holes galvanised steel straps for cables larger than 53 mm.
  - .2      Channel type supports for two (2) or more cables.
  - .3      Threaded rods: 6 mm diameter to support suspended channels.
- .7      Connectors:
  - .1      Watertight, approved for TECK cable.

**2.4            ARMOURED CABLES UPSTREAM (VFD)**

- .1      Armoured cable upstream VFD must be compliant to CSA C22.2 N° 123-96 and CSA C22.2 N° 174-M1984.
- .2      Insulation : 1 000 V.
- .3      Conductors: copper.

- .4 Cable connectors as recommended by Manufacturer.
- .5 Manufacturer: DriverRx from Nexans or equivalent.

## **2.5 CONTROL CABLES**

- .1 Type: LVT: 2 or more soft annealed copper conductors, sized as indicated:
  - .1 Insulation: thermoplastic.
  - .2 Sheath: thermoplastic jacket, and armour of closely wound aluminum wire.
- .2 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated:
  - .1 Insulation: PVC, TW 40 degrees C, or polyethylene.
  - .2 Shielding: tape coated with paramagnetic material or braid.
  - .3 Overall covering: PVC jackets, interlocked armour of aluminum strip.

## **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 required 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 - (0-1,000 V).
- .2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .3 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .4 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.
- .5 Do not use supports or equipment installed for other trades for conduit or cable support.
- .6 Branch circuit wiring for 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;
  - .2 In underground ducts in accordance with Section 26 05 43.01.

### **3.4 INSTALLATION OF ARMOURED CABLES**

- .1 In general, all wiring is in conduit. However, the following options are allowed in the following special cases:
  - .1 Where the ceilings are open (removable tiles) or gypsum, the basic frame of the lighting circuits must be in conduit with junction boxes anchored to the building structure and spread evenly over the entire surface of the facility. From junction boxes distributed, it is possible to connect each fixture individually with armored cable AC-90. However, it should not be more than four fixtures individually connected to each junction box and the maximum allowable cable length is 5 m.
  - .2 The armored cable AC-90 can also be used in the same manner and under the same conditions as for luminaries in paragraph 3.2.1.1 for receptacles and heaters in the walls covered with gypsum board. The maximum allowable cable length is 5 m.
- .2 The "daisy chain" connection is not allowed.
- .3 Group cables wherever possible.
- .4 Unless otherwise indicated, all wiring is hidden in the architectural elements. Unless otherwise specified, no surface installation is permitted without prior approval of the Engineer.

### **3.5 INSTALLATION OF TECK90 CABLE (0 -1000 V)**

- .1 Group cables wherever possible on channels.

### **3.6 INSTALLATION OF ARMOURED CABLES UPSTREAM VFD**

- .1 Follow the recommendations of the manufacturer.

### **3.7 INSTALLATION OF CONTROL CABLES**

- .1 Install control cables in conduit.
- .2 Ground control cable shield.

### **3.8 INSTALLATION OF CABLES FURNISHED WITH EQUIPMENT**

- .1 Install the cables furnished with equipments, instruments or components in conduit, flexible or rigid, metallic or not, depending of the application.
- .2 Use the appropriate connectors.
- .3 Squeeze connectors are not permitted for connecting cables directly to equipment, instrument or components.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Section 26 05 00 - Common Work Results - Electrical.
- .3 Section 26 05 01 – Electricity - Generals Informations of Works.
- .4 Section 26 05 21 - Wires and Cables (0-1000 V).

**1.2 REFERENCES**

- .1 Execute all the works, respecting the effective edition of the Construction Code of Quebec.
- .2 Execute all the works, respecting the effective edition of each code or norm having jurisdiction, including but not limited to:
  - .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE).
    - .1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.
  - .2 Canadian Standards Association (CSA International).

**1.3 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 Ministerial Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

**1.4 DESCRIPTION**

- .1 New networks MALT will be installed as shown in drawings.
- .2 All new electrical equipment must be connected to MALT networks.
- .3 The installation of equipment covered MALT in this section include without limitation the grounding of electrical and mechanical equipment, steel support, piping, ventilation doors and steel plates supporting equipment. The contractor must realize the ground between each equipment or material and MALT network point as close as possible to the equipment grounding.

- .4 Type connection provided, general way are:
  - .1 Connection by connection of the thermal grounding conductors;
  - .2 Connection to MALT bar;
  - .3 Connection by lug some equipment;
  - .4 Material supplied must be of high quality and CSA approved.

## **Part 2 Products**

### **2.1 EQUIPMENT**

- .1 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated or required by table 17 of the Construction Code of Quebec.
- .2 Insulated grounding conductors: green, size as indicated or required by table 16 of the Construction Code of Quebec.
- .3 Block of copper MALT of 50 mm x 6 mm including support insulating, the fixation and connectors.
- .4 Necessary accessory anticorrosion in system of MALT.

## **Part 3 Execution**

### **3.1 INSTALLATION GENERAL**

- .1 Install complete permanent, continuous grounding system including, conductors, connectors, accessories, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .4 Soldered joints not permitted.
- .5 Ground secondary service pedestals.
- .6 All joints and connectors must be done by fusion equivalent to Thermoweld from Burny or Cadweld from C.L.M.

### **3.2 SYSTEM AND CIRCUIT GROUNDING**

- .1 Install system and circuit grounding connections.

### **3.3 EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, duct systems, frames of motors, starters, control panels, building steel work, distribution panels, outdoor lighting and VFDs.

**3.4 FIRE ALARM SYSTEMS**

- .1 Install grounding connections for fire alarm system as follows:
  - .1 Fire alarm: As recommended by the manufacturer.

**3.5 FIELD QUALITY CONTROL**

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

**END OF SECTION**





**Part 1            General**

**1.1               RELATED SECTIONS**

- .1        Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2        Section 26 05 01 – Electricity - Generals Informations of Works.
- .3        Section 26 05 30 - Seismic Restraint Systems (SRS).

**1.2               REFERENCES**

- .1        Execute all the works, respecting the effective edition of the Construction Code of Quebec.

**1.3               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 Ministerial 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 or set in poured concrete walls and ceilings.
- .2        Supports of equipments must be in galvanised steel.
- .3        Supply all the supports for all equipments in order to have a complete installation. For example, the supports for junction boxes, receptacles, conduits etc., are not shown in drawings but they must be supplied and installed. Supply and install support channels in galvanised steel on vertical between the wall and the panel for all new panel installed on the wall. For precast supports, follow the installation recommendations from the manufacturer.
- .4        Fixation fasteners must be metallic. Plastic fasteners are not permitted.
- .5        Mechanical protection for conduit PVC, FT-4 to place required by the code.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1      Secure equipment to masonry, tile and plaster surfaces with lead anchors.
- .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 galvanized steel clamps to secure surface conduits and cables 53 mm and smaller.
  - .2          Two-hole galvanized steel clamps for conduits and cables larger than 53 mm.
- .7      Beam clamps to secure conduit to exposed steel work.
- .8      Suspended support systems:
  - .1          Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
  - .2          Support two (2) or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .9      For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .10     Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .11     Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .12     Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .13     Do not use supports or equipment installed for other trades for conduit or cable support.
- .14     Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .15     Galvanised steel supports, with retaining clamps for conductors (Building wire) in vertical conduits spaced in accordance to Table 21 of the Construction Code of Quebec, Chapter V – Electrical. This supports have to preserve the continuity of the conduit without damaging the conductors. Anchor the supports inside the boxes.

- .16 Galvanised steel supports, with retaining clamps for vertical cables (armoured cables) spaced in accordance to Table 21 of the Construction Code of Quebec, Chapter V – Electrical. This supports have to preserve the weight of cables without damaging their armour. Anchor the supports.
- .17 Install mechanical protection for conduit PVC, FT-4 to place required by the code.

**END OF SECTION**



**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 26 05 00 – Common Work Results – Electrical.
- .2 Section 26 05 01 – Electricity - Generals Informations of Works.

**1.2 REFERENCES**

- .1 Unless otherwise indicated, carry out all the work in accordance with the current edition of the Quebec Construction Code.
- .2 Also, conduct work in accordance with the current edition of any other code or standard having jurisdiction, which includes but is not limited to:
  - .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
    - .1 ASHRAE, Applications Handbook (SI).
  - .2 American Society for Testing and Materials International (ASTM).
    - .1 ASTM E488, Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.
- .3 NRC-CNRC; Quebec Construction Code, Chapter 1 - Electricity; National Building Code of Canada, current edition.
- .4 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).
  - .1 SMACNA, Addendum No. 1, to Seismic Restraint Manual, Guidelines for Mechanical Systems.
  - .2 SMACNA, Seismic Restraint Manual, Guidelines for Mechanical Systems.
- .5 Canadian standard association (CSA)
  - .1 CSA – S832.

**1.3 SUBMITTAL PROCEDURES**

- .1 Shop drawings:
  - .1 Submit, for information purposes, the required shop drawings in accordance with the general sections showing all installation details, calculations and technical data for the seismic measures planned to comply with prevailing standards.
  - .2 All equipment to come from a single manufacturer with experience in the field.
- .2 Data Sheets:
  - .1 Submit the required data sheets in accordance with the general sections.
- .3 Samples:
  - .1 Not used.

**1.4 RESPONSIBILITIES**

- .1 Each Contractor is responsible for the seismic measures related to its discipline.

- .2 Following a seismic event, there is no need for the equipment and electromechanical systems to remain operational. During a seismic event, the seismic restraint system (SRS) prevents mechanical and electrical systems from moving, overturning and causing personal injury.
- .3 Seismic restraint devices and systems must be designed by a Professional Engineer hired by the Contractor and registered in the Province of Quebec. Documents must be signed and sealed by an engineer specializing in the field.

## **1.5 SEISMIC PARAMETERS**

- .1 Refer to NBC.

## **1.6 PROTECTION LEVEL**

- .1 For piping and electrical conduits, install seismic anchoring and stabilization devices in accordance with the requirements set out in the SMACNA "Seismic Restraint Manual."
- .2 Determine protection level by calculating the seismic design lateral force. SHL-A protection level designed to withstand lateral seismic force equal to 48% of weight of equipment. SHL-B designed to withstand lateral seismic force equal to 30% of weight of equipment. SHL-C is designed to withstand lateral seismic force equal to 15% of weight of equipment.

## **1.7 SERVICES OF AN ENGINEER**

- .1 Retain the services of an engineer, member of the Quebec Order of Engineers, specializing in seismic protection of mechanical installations. The engineer must have a good knowledge of ASHRAE and SMACNA standards and the requirements of NBC Part 4 relating to calculation of seismic supports.
- .2 Provide engineer's curriculum vitae upon request by the Departmental Representative.
- .3 The engineer shall:
  - .1 Prepare a complete design of the seismic systems and devices required for all electrical installations.
  - .2 Prepare shop drawings and provide all data sheets and any other items associated with the design;
  - .3 Conduct periodic site visits to review the quality of the work;
  - .4 Prepare, sign and seal a certificate of compliance upon completion of concealed work and at final completion of the work.

## **Part 2 Products**

### **2.1 GENERAL**

- .1 Attach electrical equipment mounted on suspended ceilings directly to the building structure.
- .2 SRS to prevent permanent displacement and damage caused by horizontal or vertical movement and overturning

- .3 SRS to be fully compatible with electromechanical design. SRS must not hinder normal operation of electromechanical systems
- .4 SRS to restrain seismic forces in every direction and provide gentle and steady cushioning. SRS must not interfere with noise reduction and anti-vibration components.
- .5 Fasteners and attachment points to withstand same maximum loads as seismic restraints.
- .6 Do not use drilled or power driven anchors and fasteners or holes drilled for this purpose.
- .7 No equipment, equipment supports or mounts to fail before failure of structure.
- .8 Do not use cast iron or threaded pipe supports.
- .9 Seismic control measures must not affect operation or integrity of firestopping.
- .10 Accessories such as speakers and light fixtures installed in suspended ceilings or surface-mounted must be stabilized and specifically designed to withstand a seismic event.
- .11 Electrical equipment such as MCC, panelboards, control panels, distribution transformer, etc., surface or wall-mounted must be stabilized and specifically designed to withstand a seismic event.

## **2.2 SEISMIC RESTRAINT SYSTEM (SRS)**

- .1 Supports to have longitudinal and transverse bracing; use rigid rods or cables.
- .2 Do not stabilize equipment if length of hanger rods is less than 300 mm.
- .3 Stabilize piping and electrical conduits 35 mm nominal diameter and higher, located in equipment rooms.
- .4 Stabilize piping and electrical conduits 53 mm nominal diameter and higher.
- .5 Install mechanical restraint devices at the following frequency:
  - .1 Transverse stabilization:
    - .1 SHL-A: every 6.1 linear metres;
    - .2 SHL-B: every 10 linear metres;
    - .3 SHL-C: every 12.2 linear metres;
  - .2 Longitudinal stabilization:
    - .1 SHL-A: every 12 linear metres;
    - .2 SHL-B: every 20 linear metres;
    - .3 SHL-C: every 24.4 linear metres;
- .6 Transverse bracing may used as longitudinal bracing if installed within 600 mm of change in direction of conduit or piping.

## **2.3 STATIC EQUIPMENT**

- .1 Attach equipment to hangers that are fastened to the frame.
- .2 Use one or more of the methods listed below or as directed:
  - .1 Install tight to structure.
  - .2 Cross-brace in every direction.
  - .3 Brace back to structure.

- .4 Use slack cable restraint system to stabilize mechanically.
- .3 SRS to prevent equipment from horizontal sway and vertical rocking.
- .4 Hanger rods to withstand buckling.

## **2.4 EQUIPMENT SUSPENDED WITH ISOLATORS**

- .1 Attach equipment to hangers that are fastened to the frame by cables.
- .2 Cushioning action to be gentle and steady.
- .3 SRS not to jeopardize noise and vibration isolation systems. During normal operation, provide 6 mm-12 mm clearance between seismic restraint devices and equipment.

## **2.5 EQUIPMENT SUPPORTED WITH ISOLATORS**

- .1 If seismic isolators are used, design and install to withstand minimum acceleration forces.
- .2 Effectiveness of devices to withstand compressive loading.
- .3 Where standard isolators are used, incorporate seismic restraints into vibration isolation system to prevent overturning.
- .4 SRS must not jeopardize noise and vibration isolation systems. During normal operation, provide 6 mm-12 mm clearance between seismic restraint devices and equipment.

# **Part 3 Execution**

## **3.1 INSTALLATION**

- .1 SRS to meet requirements of Quebec Construction Code, current edition
- .2 Fasteners and anchor points to withstand same maximum loads as SRS.
- .3 Ensure piping and electrical conduit connections to isolated equipment do not reduce the flexibility of anti-vibration system and that piping and conduits passing through walls and floors do not transmit vibrations.
- .4 For devices not equipped with attachment points, add such or install attachment belts.
- .5 Stabilize structural bases of equipment to prevent overturning.
- .6 Provide 25 mm clearance between a seismic device and equipment or service component.

## **3.2 ANCHORS**

- .1 Check that anchor bolts, dowel pin diameters, recess depths in concrete and weld lengths comply with drawings.
- .2 Bolt equipment not isolated against vibration transmission to the frame or structure.
- .3 Do not use oblong openings for bolt adjustment.
- .4 Small pipes may be rigidly secured to larger pipes for seismic restraint purposes, but not the reverse.



- .5 Distance of anchor points in concrete slabs from edges to comply with ASTM E488 and manufacturer's recommendations.

### **3.3 SLACK CABLE RESTRAINT SYSTEM**

- .1 Connect to suspended equipment so that axial projection of wire passes through centre of gravity of equipment.
- .2 Use appropriate grommets, shackles and other hardware to ensure alignment of restraints and to avoid bending cables at connection points.
- .3 Orient restraint cables on suspended electrical or mechanical equipment at 90° to each other; tie back to the building's structural ceiling at maximum 90°.
- .4 Adjust cable tension to provide 19 mm slack. Cables must not bear equipment weight during normal operation.

### **3.4 MANUFACTURER'S FIELD SERVICES:**

- .1 SRS Design Engineer shall visit the site to verify installation and assembly. Design Engineer shall submit a report and recommendations to the Departmental Representative.
- .2 Notify Departmental Representative of SRS Design Engineer's visit at least 24 hours in advance.
- .3 Where applicable, make adjustments and corrections recommended in the written report submitted by the supplier.

**END OF SECTION**



**Part 1            General**

**1.1            RELATED SECTIONS**

- .1      Section 01 33 00 - Submittal Procedures.
- .2      Section 01 74 21 Construction/Demolition Waste Management and Disposal.
- .3      Section 26 05 00 - Common Work Results for Electrical.
- .4      Section 26 05 01 – Electricity - Generals Informations of Works.

**1.2            REFERENCES**

- .1      Execute all the works, respecting the effective edition of the Construction Code of Quebec.
- .2      Execute all the works, respecting the effective edition of each code or norm having jurisdiction, including but not limited to:
  - .1          Canadian Standards Association (CSA International).
  - .1          CSA C22.1, Canadian Electrical Code, Part 1, Effective version.

**1.3            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 Quebec, Canada.

**1.4            DELIVERY, STORAGE AND HANDLING**

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

**Part 2           Products**

**2.1            SPLITTERS**

- .1      Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2      Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

## **2.2 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 covers.

## **2.3 CABINETS**

- .1 Type E Empty: surface return flange mounting as indicated.
- .2 Type T Terminal: surface return flange mounting as indicated containing 19 mm fire-rated plywood backboard.

## **Part 3 Execution**

### **3.1 SPLITTER INSTALLATION**

- .1 Mount plumb, true and square to building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

### **3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION**

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
- .3 Install terminal block as indicated in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install additional pull boxes in order to avoid more than 30 m distance and 3 elbows with a right angle or equivalent between boxes for the electrical distribution and 2 elbows with a right angle for other conduit networks or empty conduits.
- .5 All pull and junction boxes must have the appropriate size depending of the numbers and size of conductors.

### **3.3 IDENTIFICATION**

- .1 Identification Labels: Size 2 indicating system name, feeding source, permissible current, voltage and phase.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED SECTIONS**

- .1    Section 01 33 00 - Submittal Procedures.
- .2    Section 01 61 00 - Common Product Requirements.
- .3    Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .4    Section 26 05 00 - Common Work Results for Electrical.
- .5    Section 26 05 01 – Electricity - Generals Informations of Works.

**1.2            REFERENCES**

- .1    Execute all the works, respecting the effective edition of the Construction Code of Quebec.
- .2    Execute all the works, respecting the effective edition of each code or norm having jurisdiction, including but not limited to:
  - .1    Canadian Standards Association (CSA International).
    - .1    CSA C22.1, Canadian Electrical Code, Part 1, Effective version.
    - .2    CSA C22.2 n°40, Cutout, Junction and Pull Boxes, Effective version.

**1.3            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 and 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.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .4 Extension and plaster rings for flush mounting devices in finished plaster or tile walls.

## **2.3 MASONRY BOXES**

- .1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

## **2.4 CONCRETE BOXES**

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

## **2.5 CONDUIT BOXES**

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface mounting of switches and receptacles.

## **2.6 OUTLET BOXE FOR CABLES WICH NOT METALLIC JACKET**

- .1 Electro steel boxes which can be grouped by screwing of at least 76 mm x 50 mm with two double clamps for cables with not metallic jacket.

## **2.7 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 32 mm 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 armored 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.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .3 Section 26 05 00 - Common Work Results for Electrical.
- .4 Section 26 05 01 – Electricity - Generals Informations of Works.

**1.2 REFERENCES**

- .1 Execute all the works, respecting the effective edition of the Construction Code of Quebec.
- .2 Execute all the works, respecting the effective edition of each code or norm having jurisdiction, including but not limited to:
  - .1 Canadian Standards Association (CSA International).
    - .1 CAN/CSA C22.2, No. 18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
    - .2 CSA C22.2, No. 45, Rigid Metal Conduit.
    - .3 CSA C22.2, No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
    - .4 CSA C22.2, No. 211.2 M1984 (R2003), Rigid PVC (Unplasticized) Conduit.
    - .5 CSA-22.2, No. 83, Electrical Metallic Tubing.

**1.3 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 and 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.

## **1.5 GENERAL**

- .1 Conduits are not fully indicated on drawings. Indicated conduits are schematic.
- .2 All conduit to have 21 mm diameter or larger.
- .3 Inside pumping station, all conduits are EMT and unless otherwise indicated on the surface and/or in entreplafond, no conduits must be buried in concrete or in slabs.

## **Part 2 Products**

### **2.1 CONDUITS**

- .1 Rigid metal conduit: hot dipped galvanized steel threaded.
- .2 EMT (electrical tube metallic) conduit.
- .3 Flexible metal conduit and steel liquid-tight flexible metal.
- .4 All conduit to have 21 mm diameter or larger.

### **2.2 CONDUIT FASTENINGS**

- .1 One (1) hole galvanized steel straps to secure surface conduits 53 mm and smaller.
  - .1 Two (2) holes steel straps for conduits larger than 53 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports in galvanized steel for two or more conduits.
- .4 Threaded rods in galvanized steel, 6 mm diameter, to support suspended channels.
- .5 Fixation fasteners must be metallic. Plastic fasteners are not permitted.
- .6 Mechanical protection for conduit PVC, FT-4 required by the code.

### **2.3 CONDUIT FITTINGS**

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 27 mm and larger conduits.
- .3 Steel watertight connectors and waterproof couplings.
  - .1 Fitting of type with compression.
  - .2 Fitting of type with screw pressure are forbidden.

### **2.4 EXPANSION FITTINGS FOR RIGID CONDUIT**

- .1 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 21 mm deflection.
- .2 Weatherproof expansion fittings for linear expansion at entry to panel.

### **2.5 FISH CORD**

- .1 Polypropylene.



**Part 3 Execution**

**3.1 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 and in unfinished areas.
- .3 Use rigid hot dipped galvanized steel threaded conduit embedded in the concrete, exposed to exterior, installation explosion proof or where it may be damage.
- .4 Use rigid hot dipped galvanized steel in the case of the external surface installation.
- .5 Armored cables are permitted between the connection box in the ceiling and the fixture or wiring devices installed in gypsum walls, when the circuits have 2,3or 4 conductors #12 size. Maximum length: 5 m.
- .6 Use rigid PVC conduit underground outside limit foundation building and EMT conduit in surface inside building.
- .7 Use flexible metal conduit in case of installation of removable metallic partition.
- .8 Use flexible metal conduit for connection to motors and other equipment subject to vibrations in dry areas. Total length not to exceed 1 m.
- .9 Daisy chain connections are not permitted.
- .10 Bend Conduit Cold. Replace conduit if kinked or flattened more than 1/10<sup>th</sup> of its original diameter.
- .11 Mechanically bend steel conduit over 21 mm diameter.
- .12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .13 Install fish cord in empty conduits.
- .14 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .15 Dry conduits out before installing wire.
- .16 Install a metal support in the ceiling "T" for installation of exit signs and fire detectors.
- .17 Install an expansion fitting for all conduits which pass through a building expansion joint.
- .18 Install mechanical protection for conduit PVC, FT-4 required by the code.

**3.2 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 Group conduits wherever possible on suspended or surface channels.
- .4 Do not pass conduits through structural members except as indicated.
- .5 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

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**3.3 CONCEALED CONDUITS**

- .1 Do not install horizontal runs in masonry or gypsum walls.
- .2 Run parallel or perpendicular to building lines.
- .3 Anchor solidly all the concealed conduit, including those installed above the suspended ceilings

**3.4 CONDUITS UNDERGROUND**

- .1 Slope conduits to provide drainage.

**END OF SECTION**

**Part 1            General**

**1.1               RELATED SECTIONS**

- .1      Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2      Section 26 05 00 - Common Work Results - Electrical.
- .3      Section 26 05 01 – Electricity - Generals Informations of Works.

**1.2               REFERENCES**

- .1      Execute all the works, respecting the effective edition of the Construction Code of Quebec.
- .2      Execute all the works, respecting the effective edition of each code or norm having jurisdiction, including but not limited to:
  - .1          Canadian Standards Association, (CSA)/CSA International.
  - .2          Insulated Cable Engineers Association, Inc. (ICEA).

**1.3               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 packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4      Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Ministerial Representative.
- .5      Fold up metal banding, flatten and place in designated area for recycling.

**Part 2            Products**

**Not used**

**Part 3            Execution**

**3.1               CABLE INSTALLATION IN DUCTS**

- .1      Install cables as indicated in ducts.
- .2      Do not pull spliced cables inside ducts.
- .3      Install multiple cables in duct simultaneously.
- .4      Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

- .5 To facilitate matching of color coded multiconductor control cables reel off in same direction during installation.
- .6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .7 After installation of cables, seal duct ends with duct sealing compound.
- .8 Install cables in ducts, without exceeding the filling rate, as indicated in the table 8 of the Construction code of Quebec, Chapter V- Electricity (effective version).
- .9 Install conductors of the same size, without exceeding the maximum number, as indicated in the table 6 of the Construction code of Quebec, Chapter V- Electricity (effective version).

### **3.2 FIELD QUALITY CONTROL**

- .1 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .2 Check phase rotation and identify each phase conductor of each feeder.
- .3 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- .4 After installing cable but before splicing and terminating, perform insulation resistance test with 1,000 V megger on each phase conductor.
- .5 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Provide the ministerial Representative with list of test results showing location at which each test was made, circuit tested and result of each test.
- .7 Remove and replace entire length of cable if cable fails to meet any of test criteria.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED SECTIONS**

- .1    Section 01 33 00 - Submittal Procedures.
- .2    Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .3    Section 26 05 00 - Common Work Results - Electrical.
- .4    Section 26 05 01 – Electricity - Generals Informations of Works.

**1.2            REFERENCES**

- .1    Execute all the works, respecting the effective edition of the Construction Code of Quebec.
- .2    Execute all the works, respecting the effective edition of each code or norm having jurisdiction, including but not limited to:
  - .1    Canadian Standards Association (CSA International).
    - .1    CSA-C22.2, No. 42, General Use Receptacles, Attachment Plugs and Similar Devices.
    - .2    CSA-C22.2, No. 42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
    - .3    CSA-C22.2, No. 55, Special Use Switches.
    - .4    CSA-C22.2, No. 111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

**1.3            SHOP DRAWINGS AND PRODUCT DATA**

- .1    Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

**1.4            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 packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4    Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Ministerial Representative.

**Part 2 Products**

**2.1 RECEPTACLES**

- .1 Duplex receptacles, "Specification Grade" type, 125 V, 15 A, "U" ground, with following features:
  - .1 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 (8) back wired entrances, four side wiring screws.
  - .5 Triple wipe contacts and rivetted grounding contacts.
  - .6 Color: receptacles on normal power to be colour white; receptacles on emergency power to be colour red.
- .2 Other receptacles with ampacity and voltage as indicated.
- .3 Receptacles of one manufacturer throughout project.

**2.2 COVER PLATES**

- .1 Provide cover plates for wiring devices.
- .2 Cover plates from one manufacturer throughout project.
- .3 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.
- .4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles installed outdoor or in humid locations.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 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 - Electrical or as indicated.
  - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
  - .4 Do not connect wiring only with screws.
- .2 Cover Plates:
  - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
  - .2 Install suitable common cover plates where wiring devices are grouped.

- .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
- .3 Make tests in accordance with effective standards and supply a report.
- .4 Do not install back to back outlets. A minimum 150 mm horizontal space must be left between boxes.

**END OF SECTION**





**Part 1            General**

**1.1            RELATED SECTIONS**

- .1        Section 26 05 00 - Common Work Results for Electrical.
- .2        Section 26 05 01 – Electricity - Generals Informations of Works.

**1.2            REFERENCES**

- .1        Unless otherwise indicated, perform all work in accordance with current edition of Quebec Construction Code.
- .2        Furthermore, perform work in accordance with current edition of any other code or standard having jurisdiction, including but not limited to :
  - .1        Canadian Standards Association (CSA)
    - .1        CSA C22.2No.248.12-[94] , Low Voltage Fuses Part 12: Class R (Bi-National Standard with, UL 248-12 (1st Edition).

**1.3            SHOP DRAWINGS AND PRODUCT DATA**

- .1        Shop drawings:
  - .1        Submit shop drawings in accordance with general section.
- .2        Product data:
  - .1        Submit product data in accordance with general section.
  - .2        Submit fuse performance data characteristics for each fuse type and size above 200 A. Performance data to include: average melting time-current characteristics.

**1.4            WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate and recycle waste materials in accordance with general Section.
- .2        Place materials defined as hazardous or toxic waste in designated containers.
- .3        Containers are sealed and stored safely for disposal.
- .4        Collect and separate plastic, paper packaging and corrugated cardboard in accordance with ministerial Representative.

**1.5            DELIVERY AND STORAGE**

- .1        Ship fuses in original containers.
- .2        Do not ship fuses installed in switchboard.
- .3        Store fuses in original containers in storage cabinet

**1.6 MAINTENANCE MATERIALS**

- .1 Three spare fuses of each type and size installed above 600 A.
- .2 Six spare fuses of each type and size installed up to and including 600 A.

**Part 2 Products**

**2.1 FUSES GENERAL**

- .1 Fuse type references L1, L2, J1, R1, etc. have been adopted for use in this specification.
- .2 Fuses: product of one manufacturer for entire project.
- .3 Fuses conform CSA C22.2 #106

**2.2 FUSE TYPES**

- .1 Class L fuses (formerly HRC-L ) 200 kA.
  - .1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
  - .2 Type L2, fast acting.
- .2 Class J fuses (formerly HRCI- J) 200 kA.
  - .1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
  - .2 Type J2, fast acting.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure correct fuses fitted to physically matched mounting devices.
- .3 Ensure correct fuses fitted to assigned electrical circuit.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED SECTIONS**

- .1      Section 01 33 00 – Submittal Procedures.
- .2      Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .3      Section 26 05 00 - Common Work Results – Electrical.
- .4      Section 26 05 01 – Electricity - Generals Informations of Works.

**1.2            REFERENCE STANDARDS**

- .1      Unless otherwise indicated, perform all work in accordance with current edition of Quebec Construction Code.
- .2      Furthermore, perform work in accordance with current edition of any other code or standard having jurisdiction, including but not limited to:
  - .1          Canadian Standards Association (CSA)/CSA International.
    - .1              CAN/CSA C22.2 No.4, Enclosed Switches.

**1.3            SUBMITTAL PROCEDURES**

- .1      Submit data sheets in accordance with Section 01 33 00 - Submittal Procedures.

**1.4            HEALTH AND SAFETY**

- .1      Health and safety in accordance with Section 01 35 29.06 – Health and Safety Requirements.

**1.5            WASTE MANAGEMENT AND DISPOSAL**

- .1      Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2      All packaging materials are to be removed from site and disposed of at appropriate recycling facilities.
- .3      Place all paper, plastic, polystyrene and corrugated cardboard packaging materials in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4      Separate for reuse and recycling, and place in designated containers, plastic, steel and other metal waste in accordance with Waste Management Plan.
- .5      Fold metal banding, flatten and place in designated area for recycling.

**Part 2           Products**

**2.1            DISCONNECT SWITCHES**

- .1      Non-fused disconnect switches in enclosures in accordance with site identification.

- .2 Provision for padlocking in ON-OFF position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Quick-make, quick-break action.
- .5 ON-OFF switch position indication on switch enclosure cover.
- .6 Heavy-duty manufacture.
- .7 Equip switches installed in circuits between variable frequency drives and motors with an electric lock comprising one N/O contact and one N/C contact to open the control circuit before switch contacts open.

## **2.2 EQUIPMENT IDENTIFICATION**

- .1 Identify equipment in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Size 4 nameplate.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install switches as indicated in the plans;
- .2 Install switches for easy operation of lever with left arm.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED SECTIONS**

- .1    Section 01 33 00 - Submittal Procedures.
- .2    Section 01 61 00 - Common Product Requirements.
- .3    Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .4    Section 01 78 00 - Closeout Submittals.
- .5    Section 26 05 00 - Common Work Results - Electrical.
- .6    Section 26 05 01 – Electricity - Generals Informations of Works.
- .7    Section 29 00 10 – Functional description.
- .8    Section 44 40 00 – Functional description.

**1.2            REFERENCES**

- .1    Unless otherwise indicated, perform all work in accordance with current edition of Quebec Construction Code.
- .2    Furthermore, perform work in accordance with current edition of any other code or standard having jurisdiction, including but not limited to:
  - .1    Canadian Standards Association (CSA)/CSA International.
  - .2    International Electrotechnical Commission (IEC)
    - .1    IEC 947-4-1-2002, Part 4: Electromechanical contactors and motor-starters.

**1.3            SHOP DRAWINGS AND PROJECT DATA**

- .1    Submit shop drawings and product data in accordance with Section 01 33 00.
- .2    Drawings to include the following:
  - .1    Mounting method and dimensions.
  - .2    Starter size and type.
  - .3    Layout of identified internal and front panel components.
  - .4    Enclosure types.
  - .5    Wiring diagram for each starter type.
  - .6    Interconnection diagrams.

**1.4            CLOSEOUT SUBMITTALS**

- .1    Provide replacement materials or equipment in accordance with Section 01 78 00 - Closeout Submittals.
- .2    Submit operation and maintenance data for each type and style of motor starter for inclusion in maintenance manual.

- .3 Extra Materials:
  - .1 Provide listed spare parts for each size and type of starter:
    - .1 3 contacts, stationary;
    - .2 3 contacts, movable;
    - .3 1 contact, auxiliary;
    - .4 1 control transformer;
    - .5 1 operating coil;
    - .6 2 fuses;
    - .7 10% indicating lamp bulbs used.

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

- .1 Deliver, store and handle equipment and materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver equipment and materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Packaging Waste Management: recover for reuse/recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

## **Part 2 Products**

### **2.1 EQUIPMENT**

- .1 Starters: to EEMAC E14-1.
- .2 Do not use reduced voltage starters.
- .3 Sized as indicated; type rated power and enclosure as indicated.
- .4 Motor overload protective device in each phase, manual reset from outside enclosure.
- .5 Install in enclosure or in motor control centre;
- .6 Size control transformers for starters load plus 25% spare capacity. Minimum 100 V A.
- .7 Equip electronic reduced voltage (soft-start) starters, full-voltage starters and variable frequency drives in MCC or control panels with accessories required for functions described in operating sequence. For operating sequences, see Automation and Process discipline. All motor starters (electronic reduced voltage (soft-start) starters, full voltage starters and variable frequency drives installed in MCCs or control panels must include all the accessories required (selector, push button, dry contact, analog input/output, keyboard, communication module, etc.) to function as described in section 29 00 00 and in accordance with the operating sequences described in section 44 40 00, and to send the proper signals to the automations pertaining to the state of the starters and the control panels (Fault, Overload, Manuel-Off-Auto mode).
- .8 Unless otherwise indicated in the drawings, equip starters with thermal protection relays operating with a thermistor probe in the motor: 1 relay for motors 25 HP to 200 HP, 2

relays for motors at or above 200 HP for mechanical process motors, 1 relay for motors at or above 20 HP for motors for building mechanicals (Section 23).

- .9 Clearly identify internal wiring between components and terminals connecting external conductors.

## **2.2 FINISH**

- .1 Apply finishes to enclosures in accordance with Section 26 05 00 Common Work Results - Electrical.

## **2.3 EQUIPMENT IDENTIFICATION**

- .1 Identify equipment in accordance with Section 26 05 00 Common Work Results - Electrical
- .2 Magnetic starter nameplate, white plate, black letters, size 1, engrave as indicated.

## **2.4 MULTI-SPEED STARTERS**

- .1 Multi-speed starters, CSA approved, pulse-width modulated (PWM) output, used to drive motors with variable torque or constant torque, as indicated.
- .2 In EEMAC enclosure in accordance with site identification or in MCC, as indicated.
- .3 No bypass.
- .4 General characteristics:
  - .1 100% continuous output capacity; heat dissipation capacity 100% of rated output;
  - .2 Overload current: 120% for one minute for existing torque and 150% for constant torque;
  - .3 Power factor: minimum 90%, regardless of speed, at controller input;
  - .4 Minimum efficiency: 95%, regardless of speed, with full load, at controller input;
  - .5 Voltage supply: 690 V / 3 phase / 60 Hz;
  - .6 Output voltage: 0-600 V / 3 phase;
  - .7 Output frequency 0-90 Hz;
  - .8 Overtorque: 150% for one minute at start-up, for all starting frequencies;
  - .9 Disturbance tolerance: up to 3 cycles;
  - .10 Frequency Stability:  $\pm 0.01$  Hz maximum;
  - .11 Electronic rotation reversal, regardless of speed, drive will decelerate motor before rotation inversion.
- .5 The following adjustments are possible:
  - .1 Minimum speed: adjustable from 0 to 80%;
  - .2 Maximum speed: adjustable from 50 to 150%;
  - .3 Acceleration and deceleration linear ramp from 0 to 100% of speed;
  - .4 Acceleration and deceleration times: adjustable from 0 to 180 seconds;
  - .5 Current limit: adjustable to 150% of rated current (for internal current loop);
  - .6 Programmable volts/hertz;

- .7 Overvoltage;
- .8 Motor stability;
- .9 Flow optimization in motor air gap.
- .6 General protections:
  - .1 Protection of diode bridge at input with fuses and transient voltage suppressors;
  - .2 Protection of electronic components against phase-to-phase or phase-to-ground short circuit at output;
  - .3 Protection against overvoltage or undervoltage, phase loss or phase imbalance;
  - .4 Electronic overload protection of output current (I<sub>2t</sub>);
  - .5 Electronic protection against locked rotor;
  - .6 Input/output signal isolation;
  - .7 Isolation of adjustments and control board;
  - .8 Rapid discharge circuit for power capacitors.
- .7 Controller can operate undamaged without a motor connected to the output or in open circuit.
- .8 Controller can accept opening of main switch while in operation.
- .9 Controller can have three frequency discharge points. For each discharge point, centre frequency and bandwidth are adjustable.
- .10 Remote graphic display terminal mounted on front of enclosure, alphanumeric display and keypad allows operator to adjust operating parameters and observe drive status, as described below:
  - .1 Parameters initially entered or subsequently modified by authorized persons with password;
  - .2 Speed, load torque and power expressed in %, output voltage displayed in normal operation;
  - .3 Use touchscreen in operating station to adjust and observe the following parameters:
    - .1 Operating mode: local / off / auto.
    - .2 Local mode:
      - .1 Start motor;
      - .2 Stop motor.
    - .3 Maximum speed adjustment.
    - .4 Minimum speed adjustment.
    - .5 Acceleration rate.
    - .6 Current limit, motor mode;
    - .7 At least 3 and up to 7 pre-set operating speeds with acceleration and deceleration ramps.
    - .8 Up to 3 frequency discharge points: central frequency and bandwidth displayed.



- .9 Relevant information on causes of failure or inverter shutdown to facilitate troubleshooting.
- .10 Display indicates conditions preventing expected operating conditions.
- .11 Keypad accessible on front of enclosure with door closed.
- .12 Controller equipped with integrated Modbus communication link with Ethernet Modbus communication module enabling at least the following input/output commands:
  - .1 Input:
    - .1 Receipt of run command;
    - .2 Receipt of speed command;
    - .3 Receipt of acknowledgment.
  - .2 Output:
    - .1 Operating status of motor;
    - .2 Fault status;
    - .3 Selector status: manual / off / auto;
    - .4 Return of motor rotation speed;
    - .5 Return of motor current measurement;
    - .6 Return of motor temperature measurement;
- .13 Controller equipped with 120 V AC input interfaces, connected to terminals:
  - .1 Refer to PID diagrams and operating sequence of Automation and Process discipline.
- .14 Controller equipped with 120 V AC output interfaces, connected to terminals:
  - .1 Refer to PID diagrams and operating sequences in Automation and Process discipline.
- .15 Protection against harmonics:
  - .1 Each controller provides full performance with three-phase power at 600 V AC with a maximum total harmonic distortion (THD) in an established voltage, according to IEEE 519;
  - .2 Harmonic current content of each variable frequency controller is limited to the maximum value based on the typical performance of a twelve-pulse rectifier according to IEEE 519. Point of measurement of harmonic current content at controller input. This limit applies regardless of relative speed of motor;
  - .3 Variable frequency controllers equipped with filters on DC busbar, including inductor, capacitor and smoothing inductor at AC input, and smoothing inductor at AC output to reduce amplitude of harmonic currents generated in AC power below maximum level referred to above. Smoothing inductor at AC input sized to maintain minimum power factor of 0.9 in specified operational area;
  - .4 Inductors installed at input and DV/DT filters at output of variable speed controllers determined and calculated to meet the requirements of IEEE 519.

- .16 Output inductors and filters:
  - .1 Output inductors to limit overvoltages to 1000 volts / microsecond. Provide DV/DT filters to IEEE 519;
  - .2 Provide toroidal cores (Common, Shock model).
- .17 Manufacturer: Cutler Hammer SVX9000 or equivalent.
- .18 Thermal protection relay (thermistor):
  - .1 See Article 2.6.
- .19 Thermal protection relay (RTD):
  - .1 See Article 2.7.

## **2.5 CONTROL TRANSFORMER**

- .1 Single phase, dry type, control transformer with primary voltage, as indicated, and 120 V secondary, with secondary fuse, installed in circuit with starter, as indicated.
- .2 Size control transformer for control circuit load plus 25% spare capacity.

## **2.6 THERMAL PROTECTION RELAY (THERMISTOR)**

- .1 Protective relays operating with thermistor probes in motor.
- .2 Operating at 120 V AC.
- .3 2 N/O contacts and 2 N/F contacts.
- .4 Manual or remote reset.
- .5 For motors with 6 thermistors provide 2 relays. For number of thermistors, see Automation and Process discipline.

## **2.7 THERMAL PROTECTION RELAY (RTD)**

- .1 Protective relays operating with resistance temperature detector in motor.
- .2 Operating at 120 VAC.
- .3 2 N/O contacts and 2 N/F contacts.
- .4 Manual or remote reset.
- .5 Provide relays according to RTDs. For number of RTDs, see Automation and Process discipline.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install starters and connect to power and control circuits as indicated.
- .2 Install and wire starters and controls as indicated.
- .3 If motor is not visible from manual starter or selector in front of the magnetic starter or contactor, provide and install a selector within 1500 mm of motor.

- .4 Verify information on motor nameplate and adjust overload devices to suit.
- .5 Configure and program communication parameters. Closely coordinate commissioning with Automation and Process discipline;

### **3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and manufacturer's instructions.
- .2 Operate switches and contactors to verify proper functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment and control devices operate as indicated.

**END OF SECTION**



**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 26 05 01 – Electricity - Generals Informations of Works.

**1.2 REFERENCES**

- .1 CSA International
  - .1 CSA C22.2 No.141-[10], 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.
- .3 Sustainable Design Submittals:
  - .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.
- .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 off ground 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.

- .4 Packaging Waste Management: return packaging materials in accordance with Section [01 74 21 - Construction/Demolition Waste Management.

## **1.6 WARRANTY**

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

## **Part 2 Products**

### **2.1 EQUIPMENT**

- .1 Emergency lighting equipment: to CSA C22.2 No.141.
- .2 Supply voltage: 120 V, AC.
- .3 Output voltage: 24 V DC.
- .4 Operating time: 30 minutes.
- .5 Battery: sealed, maintenance free.
- .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 and remote, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: LED, 4 W.
- .11 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.
- .12 Finish: Manufacturer standard.
- .13 Nominal power: 144 W.
- .14 Auxiliary equipment:
  - .1 Ammeter.
  - .2 Voltmeter.
  - .3 Test switch.
  - .4 Time delay relay.

- .5 Battery disconnect device.
- .6 AC input and DC output terminal blocks inside cabinet.
- .7 Bracket.
- .8 Cord and single twist-lock plug connection for AC.
- .9 RFI suppressors.

## **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 in accordance with manufacturer's recommendations.

## **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 ministerial Representative.
  - .2 Inform ministerial 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 ministerial Representative.

### **3.2 INSTALLATION**

- .1 Install unit equipment and remote mounted fixtures.
- .2 Direct heads.

### **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 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**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**