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**Part 1            General**

**1.1            REFERENCE STANDARDS**

- .1    CSA Group
  - .1    CSA C22.1, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.
  - .2    CSA C22.2 No. 0-10 (R2015). General requirements - Canadian electrical code, part II
  - .3    CAN3-C235-83 (R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

**1.2            DEFINITIONS**

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

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data:
  - .1    Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .3    Shop drawings:
  - .1    Submit drawings stamped and signed by a 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    Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
  - .4    Submit a number of copies of drawings in electronic format to authority having jurisdiction.
  - .5    If changes are required, notify Departmental Representative of these changes before they are made.
- .4    Certificates:
  - .1    Provide CSA certified material.
  - .2    Submit test results of installed electrical systems and instrumentation.
  - .3    Permits and fees: in accordance with General Conditions of contract.
  - .4    Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

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**1.4 DELIVERY, STORAGE AND HANDLING**

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

**Part 2 Products**

**2.1 DESIGN REQUIREMENTS**

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, 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 labels for control items in English and French.
- .4 Use one label for both languages.

**2.2 MATERIALS AND EQUIPMENT**

- .1 Provide material in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Material to be CSA certified. Factory assemble control panels and component assemblies.

**2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS**

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

**2.4 WIRING TERMINATIONS**

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

**2.5 EQUIPMENT IDENTIFICATION**

- .1 Identify electrical equipment with labels as follows:
- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. [\_\_\_\_] " as directed by Departmental Representative.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.

## 2.6 WIRING IDENTIFICATION

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

## 2.7 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Type	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
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 outdoor electrical equipment "equipment green" finish to Departmental Representative's instructions.

## Part 3 Execution

### 3.1 EXAMINATION

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

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**3.2 INSTALLATION**

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

**3.3 NAMEPLATES AND LABELS**

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

**3.4 FIELD QUALITY CONTROL**

- .1 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
  - .1 Circuits originating from branch distribution panels.
  - .2 Motors and associated control equipment including sequenced operation of systems where applicable.
  - .3 Insulation resistance testing:
    - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
    - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
    - .3 Check resistance to ground before energizing.
- .2 Carry out tests in presence of Departmental Representative.
- .3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of the project.

**3.5 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 CSA International
  - .1 CAN/CSA-C22.2 No.18.3-12(R2017) Conduits, tubing and cable fittings.
  - .2 CAN/CSA-C22.2 No.65-13 (R2018), Wire Connectors.
- .2 National Electrical Manufacturers Association (NEMA)

**1.2 PRODUCT DATA**

- .1 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Specifications sheet
  - .1 Submit specifications sheets required with manufacturer instructions and documentation concerning wires and box. Specifications sheets need to include product characteristics, performance criteria, sizes, limits and finish.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with the manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with the manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse as specified in [Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Pressure type wire connectors to: CAN/CSA-C22.2 No. 65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Bushing stud connectors, NEMA compliant, to consist of:
  - .1 Connector body and stud clamp for tube conductors copper.
  - .2 Stud clamp bolts.
  - .3 Bolts for copper conductors.
  - .4 Sized for conductors as indicated.
- .3 Clamps or connectors for flexible conduit, as required to: CAN/CSA-C22.2 No.18.3.

**Part 3            Execution**

**3.1            EXAMINATION**

- .1        Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with the manufacturer's written instructions.

**3.2            INSTALLATION**

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

**3.3            CLEANING**

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

**END OF SECTION**

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**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 Group CSA
  - .1 CAN/CSA C22.1-15, Canadian Electrical Code, Part I (23rd edition)
  - .2 CAN/CSA-C22.2 No 51-14 Armoured cables.
  - .3 CAN/CSA-C22.2 No 75-17-Thermoplastic insulated wires and cables.

**1.2 PRODUCT DATA**

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

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Packaging Waste Management: remove for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**Part 2 Products**

**2.1 BUILDING WIRES**

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RWU90 XLPE, Jacketted.
- .3 Neutral supported cable: 3 phase insulated conductors of Copper and one neutral conductor of Copper steel reinforced, size as indicated. Type: NS90 Insulation: Type NSF-2 flame retardant rated 600 V.

**2.2 ARMOURED CABLES**

- .1 Conductors: insulated, copper, size as indicated.
- .2 Armour: interlocking type fabricated from galvanized steel strip.
- .3 Type: flame retardant ACWU90 with PVC jacket over thermoplastic armour and compliant to applicable Building Code classification for this project wet locations.
- .4 Connectors: anti short connectors.

**Part 3 Execution**

**3.1 FIELD QUALITY CONTROL**

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

### **3.2 GENERAL CABLE INSTALLATION**

- .1 Lay cable in cable trays in accordance with Section 26 05 29 - Cable Trays for Electrical Systems.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .3 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .4 Conductor length for parallel feeders to be identical.
- .5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .6 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.

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

- .1 Group cables wherever possible on channels.

**END OF SECTION**



**Part 1            General**

**1.1            REFERENCE STANDARDS**

- .1    Group CSA
  - .1    CSA C22.1-15, Canadian Electrical Code, Part I (23rd edition)
  - .2    CAN/CSA-C22.2 numéro 62275-16, Cable management systems - Cable ties for electrical installations
  - .3    CAN/CSA-C22.2 no 18.4-15 Hardware for the support of the conduit, tubing, and cable.

**1.2            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 the manufacturer's name and address.
- .3    Storage and Handling Requirements:
  - .1    Store materials off ground and in accordance with the manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2    Replace defective or damaged materials with new.

**Part 2            Products**

**2.1            SUPPORT CHANNELS**

- .1    U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted.

**Part 3            Execution**

**3.1            EXAMINATION**

- .1    Verification of Conditions: verify that conditions of the substrate previously installed under other Sections or Contracts are acceptable for hangers and supports installation in accordance with the manufacturer's written instructions.

**3.2            INSTALLATION**

- .1    Secure equipment to hollow masonry, tile and plaster surfaces with lead anchors.
- .2    Secure equipment to poured concrete with expandable inserts.
- .3    Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .4    For surface mounting of two or more conduits use channels and space them as required by in effect electrical code.
- .5    Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .6    Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

- .7 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .8 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental.
- .9 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with the manufacturer's installation recommendations.

### **3.3 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCE STANDARD**

- .1 Canadian Standards Association / CSA International
  - .1 CSA C22.1-15, Canadian Electrical Code, Part I, 23<sup>rd</sup> edition.
  - .2 CAN/CSA-C22.2 no 18.1-13(R2018), Metallic Outlet Boxes.
  - .3 CAN/CSA-C22.2 no 18.2-06(R2016), Nonmetallic Outlet Boxes.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturers printed product literature, specifications and data sheets 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 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.

**1.3 DELIVERY, STORAGE AND HANDLING**

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

**Part 2 Products**

**2.1 JUNCTION AND PULL BOXES**

- .1 Construction: PVC boxes when connected to PVC conduits.
- .2 Weather resistant.
- .3 Conceived to receive four (4) screws plates.

**Part 3 Execution**

**3.1 JUNCTION AND PULL BOXES INSTALLATION**

- .1 Install pull boxes in accessible locations.
- .2 Only main junction and pull boxes are indicated. Install additional pull boxes as required by Canadian electrical code.

**3.2 IDENTIFICATION**

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

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-C22.2 no 18.1-13(R2018), Metallic Outlet Boxes.
  - .2 CAN/CSA-C22.2 no 18.2-06(R2016), Nonmetallic Outlet Boxes.
  - .3 CAN/CSA-C22.2 no 18.3-12 (R2017), Conduit, tubing, and cable fittings.
  - .4 CSA C22.2 no 56-17, Flexible metal conduit and liquid-tight flexible metal conduit.
  - .5 CSA C22.2 no. 85-14, Rigid PVC boxes and fittings.

**1.2 WASTE MANAGEMENT AND DISPOSAL**

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

**Part 2 Products**

**2.1 CONDUITS**

- .1 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .2 Flexible metal conduit and liquid-tight flexible metal: to CSA C22.2 No. 56.

**2.2 CONDUIT FASTENINGS**

- .1 One hole steel PVC covered straps to secure surface conduits 53 mm and smaller.
  - .1 Two hole steel PVC covered straps for conduits larger than 53 mm (2").
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits.

**2.3 CONDUIT FITTINGS**

- .1 Fittings: to CAN/CSA C22.2 No. 85, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 27 mm (1") and larger conduits.

**2.4 EXPANSION FITTINGS FOR RIGID CONDUIT**

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

**2.5 FISH CORD**

- .1 Polypropylene.

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**Part 3                      Execution**

**3.1                      MANUFACTURER'S INSTRUCTIONS**

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

**3.2                      INSTALLATION**

- .1                      Use rigid PVC conduit on roofing.
- .2                      Use liquid tight flexible metal conduit for connection to motors or vibrating equipment on roofing.
- .3                      Bend conduit cold:
  - .1                      Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .4                      Install fish cord in empty conduits.
- .5                      Remove and replace blocked conduit sections.
  - .1                      Do not use liquids to clean out conduits.
- .6                      Dry conduits out before installing wire.

**3.3                      SURFACE CONDUITS**

- .1                      Run parallel or perpendicular to building lines.
- .2                      Group conduits wherever possible on surface channels.
- .3                      Do not pass conduits through structural members except as indicated.
- .4                      Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

**3.4                      CLEANING**

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

**END OF SECTION**