

**Part 1            General**

**1.1                GENERAL**

- .1        This Section covers items common to Sections of Division 26. This section supplements the requirements of Division 01.

**1.2                CODES AND STANDARDS**

- .1        Do complete installation in accordance with CSA C22.1-2021 except where specified otherwise.
- .2        Comply with all laws, ordinances, rules, regulations, codes, and orders of all authorities having jurisdiction relating to this Work.

**1.3                DRAWINGS AND SPECIFICATIONS**

- .1        The intent of the Drawings and Specifications is to include all labour, products, and services necessary for complete Work, tested and ready for operation.
- .2        These Specifications and the Drawings and Specifications of all other divisions shall be considered as an integral part of the accompanying Drawings. Any item or subject omitted from either the Specifications or the Drawings but which is mentioned or reasonably specified in and by the others, shall be considered as properly and sufficiently specified and shall be provided.
- .3        Provide all minor items and Work not shown or specified but which are reasonably necessary to complete the Work.
- .4        If discrepancies or omissions in the Drawings or Specifications are found, or if the intent or meaning is not clear, advise the Contract Administrator for clarification before submitting Bid, in accordance with B4.

**1.4                CARE, OPERATION AND START-UP**

- .1        Instruct City maintenance and operating personnel in the operation, care and maintenance of systems, system equipment and components.
- .2        Where services of a manufacturer's factory service engineer is required, arrange and pay for services 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 all aspects of its care and operation.

**1.5 PERMITS, FEES AND INSPECTION**

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay associated fees.
- .3 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.
- .4 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Contract Administrator.

**1.6 MATERIALS AND EQUIPMENT**

- .1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Equipment and material shall be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.
- .3 Minimum enclosure type to be used is NEMA 12 unless otherwise specified. For enclosures to be installed within hazardous locations, Stainless Steel (316) NEMA 4X enclosures shall be used.

**1.7 FINISHES**

- .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.

**1.8 EQUIPMENT IDENTIFICATION**

- .1 Identify electrical equipment with nameplates as follows:
- .2 Nameplates:
  - .1 Lamacoid 3 mm thick plastic lamacoid nameplates, white background, black lettering, mechanically attached with self tapping screws.

**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

#### NAMEPLATE SIZES

Size 8                      35 x 100 mm                      3 lines                      5 mm high letters

- .3 Wording on nameplates to be approved by Contract Administrator prior to manufacture.
- .4 Allow for average of twenty-five (25) letters per nameplate.
- .5 Identification to be English.

### **1.9 CABLE IDENTIFICATION**

- .1 Identify cable with permanent indelible identifying markings on both ends of the cable.
  - .1 Cable tags to be made from lamacoid material, with black letters on a white background, and secured to the cables using stainless steel tie-wraps.

### **1.10 WIRING IDENTIFICATION**

- .1 Identify wiring with permanent indelible identifying markings on both ends of conductors.
  - .1 Wire tags to be heat shrink type with black letters on a white background.

### **1.11 MANUFACTURERS AND CSA LABELS**

- .1 Visible and legible, after equipment is installed.

### **1.12 CUTTING AND PATCHING**

- .1 Provide all cutting and patching required.
- .2 Return exposed surfaces to an as-found condition.
- .3 Exercise care where cutting holes existing concrete elements so as not to damage existing reinforcing.
  - .1 Locate existing reinforcing utilizing a reinforcing bar locator and mark out on the surface of the concrete.
  - .2 For all holes larger than 50 mm passing through reinforced concrete, mark the location of the desired hole and all adjacent rebar. Obtain approval from the Contract Administrator prior to cutting.
  - .3 Firestop and seal all penetrations, regardless of whether the penetration requires a fire rating.

### **1.13 ANCHOR INSTALLATION**

- .1 The Contractor shall exercise care where installing anchors into existing concrete elements so as not to damage existing reinforcing. All anchors shall be installed utilizing carbide tip drill bits. The existing reinforcing shall be located utilizing a reinforcing bar locator and marked out on the surface of the concrete. The drill holes shall be advanced to the required depth for installation of the anchors. Should reinforcement be encountered while drilling the hole shall be terminated and repositioned to clear the

reinforcement. Do not use core bits that can easily intercept and damage/cut the reinforcing during drilling.

#### **1.14 FIELD QUALITY CONTROL**

- .1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this division to be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province of Manitoba.

#### **1.15 TESTING**

- .1 All test instruments utilized are to have been calibrated within one year of the date utilized.
- .2 Utilize test forms to be provided by the Contract Administrator. Complete test forms in full.

#### **1.16 SUBMITTALS**

- .1 Prior to delivery of any Products to job Site and sufficiently in advance of requirements to allow ample time for checking, submit Shop Drawings for review as specified in each Division.
- .2 Submit Shop Drawings (including Product Data) for all equipment as required in each Section of this Specification.
- .3 Prior to submitting the Shop Drawings to the Contract Administrator, the Contractor shall review the Shop Drawings to determine that the equipment complies with the requirements of the Specifications and Drawings.
- .4 The term “Shop Drawing” means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data, which are to be provided by the Contractor to illustrate details of a portion of the Work. Indicate materials, methods of construction and attachment of support wiring, diagrams, connections, recommended installation details, explanatory notes and other information necessary for completion of Work. Where equipment is connected to other equipment, indicate that such items have been coordinated, regardless of the section under which the adjacent items will be supplied and installed. Indicate cross-references to Design Drawings and Specifications. Adjustments made on Shop Drawings by the Contract Administrator are not intended to change the contract price. If adjustments affect the value of the Work state such in writing to the Contract Administrator prior to proceeding with the Work.
- .5 Should Shop Drawing information be insufficient or the Contract Administrator does not approve of the Shop Drawings, the Contractor shall arrange to resubmit Shop Drawings at no additional change to contract price.

- .6 Manufacture of Products shall conform to revised Shop Drawings.

**1.17 AS-BUILT DRAWINGS**

- .1 The Contractor shall keep one (1) complete set of white prints at the Site during work, including all addenda, change orders, site instructions, clarifications, and revisions for the purpose of As-Built Drawings. As the Work on-site proceeds, the Contractor shall clearly record in Red Pencil all as-built conditions, which deviate from the original Contract Documents. As-Built Drawings to include circuiting of all devices, conduit and cable runs (complete with conductor size and number) and locations of all equipment.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.
- .2        CAN/CSA-C22.2 No. 38, Thermoset-Insulated Wires and Cables.
- .3        CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.
- .4        CAN/CSA-C22.2 No. 239, Control and Instrumentation Cables.

**1.2                PRODUCT DATA**

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

**Part 2            Products**

**2.1                SINGLE-CONDUCTOR POWER WIRE**

- .1        Wire: to CAN/CSA-C22.2 No. 38.
- .2        Conductors:
  - .1        Size as indicated on the drawings.
  - .2        Stranded for 10 AWG and larger.
  - .3        Copper conductors.
- .3        Voltage rating:
  - .1        Power circuits 480 V and less: 600 V
  - .2        Power circuits > 480 V: 1000 V
- .4        Colour coding to Section 26 05 01, wires sized 2 AWG and smaller to be factory-coded, taping will not be accepted.

**2.2                ACIC/CIC CONTROL CABLE**

- .1        Cable: to CAN/CSA-C22.2 No. 239, Control and Instrumentation Cables.
- .2        Conductors, copper, size as indicated on the Drawings.
- .3        Insulation: chemically cross-linked thermosetting polyethylene rated type RW90, 600V.
- .4        Shielding as indicated on the drawings.

**Part 3 Execution**

**3.1 GENERAL**

- .1 Do not splice cables. A continuous length is required for all feeds.
- .2 Install in accordance with manufacturer's recommendations, observing requirements for minimum bending radius and pulling tensions.

**3.2 INSTALLATION OF CONTROL CABLES**

- .1 Ground shields at one end only. Where possible, ground shields at the end where power is supplied to the cable. Utilize shield grounding bar in panels, where present, to ground overall shields. Individual pair shields to be grounded on appropriate terminals.
- .2 Shield drain wires, at the ungrounded end, are to be taped back to the cable. Fully insulate the shield. Do not cut the shield drain wire off.

**3.3 TERMINATIONS AND SPLICES**

- .1 Wire nuts are not permitted.
- .2 Terminations and splices shall be provided via DIN-rail mounted terminals only.

**3.4 INSTALLATION IN CONDUIT**

- .1 Utilize cable grips, appropriately selected to accommodate the type and geometry of the cable.
- .2 Utilize cable pulling lubricant, compatible with the cable and conduit.

**3.5 CABLE IDENTIFICATION**

- .1 Install cable tags on all field cables at both ends of the cable.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        Canadian Standards Association (CSA)
  - .1        CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
  - .2        CSA C22.2 No. 45, Electrical 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, Rigid PVC (Un-plasticized) Conduit.
  - .5        CAN/CSA C22.2 No. 227.3, Flexible Non-metallic Tubing.
- .2        Submittals
  - .1        Submit product data in accordance with Section 01 33 00 – Submittal Procedures for the following:
    - .1        Metal conduit
    - .2        Flexible metal conduit
    - .3        Conduit fittings
    - .4        Conduit hubs
    - .5        Conduit adapters

**Part 2            Products**

**2.1                FLEXIBLE METAL CONDUIT**

- .1        To CSA C22.2 No. 56, Flexible metal conduit and liquid-tight flexible metal conduit.

**2.2                ALUMINUM RIGID CONDUIT**

- .1        To CSA C22.2 No. 45, Electrical Rigid Metal Conduit.

**2.3                SCHEDULE 80 PVC CONDUIT**

- .1        To CSA C22.2 No. 211.2, Rigid PVC (unplasticized) conduit.

**2.4                CONDUIT FASTENINGS**

- .1        One (1) hole straps to secure surface conduits 50 mm in diameter and smaller.
- .2        Two (2) hole straps for conduits larger than 50 mm in diameter.
- .3        Strap material to match conduit material.
- .4        Strut mounting brackets/clamps to secure conduit to strut. Bracket/clamp material to be aluminum.

- .5 Beam clamps to secure conduits to clarifier bridge. Clamp material to be aluminum.

## **2.5 CONDUIT FITTINGS**

- .1 Fittings: manufactured for use with conduit specified.
- .2 Material: aluminum.
- .3 All fittings to be liquid and dust tight.
- .4 Enclosure Connections:
  - .1 Connections in dry locations (bottom or side)
    - .1 Locknuts inside and outside enclosures.
    - .2 Insulated bushings.
  - .2 Connections in wet locations and tops of enclosures in dry locations
    - .1 Liquid-tight threaded hubs.
    - .2 Insulated bushings.
  - .3 Utilize insulated grounding bushings at all non-metallic enclosure entries for metallic conduit, or as required for bonding in accordance with Code and good practice.
- .5 Elbows:
  - .1 Utilize factory elbows for 27mm diameter and larger conduits.
- .6 Threaded Hubs for Metal Conduit:
  - .1 Liquid and dust tight with insulated throat.
  - .2 Approved products:
    - .1 Thomas & Betts "Bullet Hub" 370AL Series or approved equal in accordance with B7.
- .7 Fittings for Metal Conduit:
  - .1 Cast aluminum.
  - .2 Gasketed covers.

## **2.6 FISH CORD**

- .1 Polypropylene.

## **Part 3 Execution**

### **3.1 ROUTING**

- .1 Locate conduits containing communication and low voltage conductors away from conduits containing power wiring.
- .2 Route conduits on existing or new pipe rack or suspended channels where possible. Conduits routing shall be installed to run parallel or perpendicular to building lines. Do not route conduit in angular directions with respect to building lines.

- .3 Avoid routes that would interfere with any potential maintenance activities.
- .4 Where not specifically shown in detail on the Drawings, review proposed conduit routing with Contract Administrator prior to installation. Comply with all routing changes requested by the Contract Administrator.

### **3.2 INSTALLATION - GENERAL**

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .3 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .4 Do not include more than the equivalent of four (4) quarter bends. Provide pull boxes as required.
- .5 Ensure electrical continuity in all metallic conduit systems.
- .6 All conduit shown exposed in finished areas is to be free of unnecessary labels and trademarks.
- .7 Seal conduits with duct seal where conduits are run between heated and unheated areas. Where conduits, cables, or cable trays pierce fire separations, seal openings with Dow Corning 3-6548 sealant, or approved equal in accordance with B7.
- .8 Install fish cord in empty conduits.
- .9 Dry conduits out before installing wire.
- .10 Install ground bonding wire in all conduits. Size ground wire as per CEC Table 17.
- .11 Surface Conduits:
  - .1 Run parallel or perpendicular to building lines. Do not run conduit in angular directions from building lines.
  - .2 Group conduits wherever possible on suspended or surface channels.
  - .3 Provide a minimum spacing of 100% of the largest conduit diameter between adjacent conduits.
  - .4 Do not pass conduits through structural members, except as indicated.
  - .5 Do not locate conduits less than 152 mm parallel to steam or hot water lines with a minimum of 25 mm at crossovers.
  - .6 Install spacers as required to provide spacing between the conduits and the supporting surface, with a minimum spacing as follows:
- .12 Colour Coding:
  - .1 Apply plastic tape or paint colour coded bands to conduits at points where conduit or cable enters wall, ceiling, or floor, and at 5 m intervals.
  - .2 Bands: 38 mm wide prime colour and 19 mm wide auxiliary colours

.3 Band colours as per the following table.

<b>System</b>	<b>Prime Band</b>	<b>Aux. Band</b>
347 / 600 V	Yellow	
120 / 208 / 240 V Power	Black	
UPS 120 / 208 / 240 V Power	Black	Green
Control Wiring (120 V)	Black	Orange
Low Voltage Communication/General	Blue	
Low Voltage Control Wiring (< 50 V)	Blue	Orange
Intrinsically Safe	Blue	White

### 3.3 METAL CONDUIT

- .1 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .2 Mechanically bend conduits over 19 mm in diameter.
- .3 Maximum spacing between supports for rigid metallic conduit:
 

.1	16mm diameter conduit:	1.0 m
.2	21mm diameter conduit:	1.5 m
.3	27mm diameter conduit	1.5 m
.4	35mm diameter conduit	2.0 m
.5	41mm diameter conduit and larger	2.5 m

### 3.4 LIQUID-TIGHT FLEXIBLE CONDUIT

- .1 Use as raceways at all motors, pipe-mounted control devices, and other devices subject to movement or water.
- .2 At all motors provide a short length before connecting to the motor terminal box. Minimum length shall be 450 mm plus four (4) times the conduit diameter.
- .3 Provide a separate ground wire within flexible conduit, bonded to motor frames and system ground.

**END OF SECTION**