

**Part 1            General**

**1.1            General Requirements**

- .1        The General Conditions, the Supplementary Conditions, the Instructions to Bidders and Division One General Requirements shall be read in conjunction with and govern this section.
- .2        The Specification shall be read as a whole by all parties concerned. Each Section may contain more or less than the complete work of any trade. The Contractor is solely responsible to make clear to the Subcontractors the extent of their work.

**1.2            References**

- .1        Canadian Standards Association (CSA International)
  - .1            CSA C22.1, Canadian Electrical Code latest edition, Part 1, Safety Standard for Electrical Installations.
  - .2            CSA C22.2 No.
- .2        Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
  - .1            EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .3        Institute of Electrical and Electronics (IEEE)
  - .1            IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

**1.3            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.

**1.4            Design Requirements**

- .1        Operating voltages: to CAN3-C235.
- .2        Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
  - .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.

**1.5            Submittals**

- .1        Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Product Data: submit WHMIS MSDS in accordance with Section 01 47 15 - Sustainable Requirements: Construction and Section 02 81 01 - Hazardous Materials.
- .3        Shop drawings:

- .1 Submit drawings stamped and signed by electrical contractor.
  - .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 on drawings clearances for operation, maintenance, and replacement of operating equipment devices.
  - .5 If changes of approved shop drawings are required, notify Departmental Representative of these changes before they are made.
  - .6 Shop drawings shall be marked to indicate job name, specification clause numbers and/or contract drawing numbers to which they refer.
  - .7 Catalogues, manuals or price lists are not acceptable as shop drawings but property marked-up cuts from manufacturers' catalogues may be used to supplement information contained in the shop drawings.
  - .8 Control diagrams form part of the shop drawings. Each diagram shall include a description of the sequence of operation, a schematic key diagram and a legend of the symbols used so that components may be easily identified. This shall include but not be limited to:
    - .1 Wiring devices.
    - .2 Service poles.
    - .3 Light fixtures.
  - .10 No fabrication of equipment shall take place until shop drawings have been reviewed by the engineer. The review of shop drawings does not relieve the contractor of the responsibility for any error in the shop drawings or changes from the contract drawings or specifications not covered by a written notification submitted by the contractor together with the shop drawings. Products listed subject to 10 working days prior to tender close for approval.
- .4 Quality Control: in accordance with Section 01 45 00 - Quality Control.
- .1 Provide CSA certified equipment and material.
  - .2 Where CSA or approved alternate certified equipment and material is not available, submit such equipment and material to inspection authorities for special 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 Departmental Representative.
- .5 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

**1.6****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 of which one must hold a valid Master Electrical Contractor license and apprentices 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 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## **1.7 System Startup**

- .1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.

- .2 Arrange and pay for services of manufacturer's factory service Departmental Representative 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.

## **1.8 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 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 Post instructions where directed.

## **Part 2 Products**

### **2.1 Materials And Equipment**

- .1 Material and equipment to be CSA or approved alternate certified. Where CSA certified material and equipment is not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.

- .2 Factory assemble control panels and component assemblies.

### **2.2 Warning Signs**

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction.

- .2 Decal signs, minimum size 152.40 mm x 254.0 mm.

## **2.3 Wiring Terminations**

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

## **2.4 Equipment Identification**

- .1 Identify electrical equipment with nameplates or labels as follows:
  - .1 Nameplates: lamicoid 3.175 mm black matt white finish face, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
  - .2 Sizes as follows:

### **NAMEPLATE SIZES**

Size 1	9.525 mm x 50.80 mm	1 line	3.175 mm high letters
Size 2	12.70 mm x 69.85 mm	1 line	4.7625 mm high letters
Size 3	12.70 mm x 69.85 mm	2 lines	3.175 mm high letters
Size 4	19.05 mm x 88.90 mm	1 line	7.9375 mm high letters
Size 5	19.05 mm x 88.90 mm	2 lines	4.7625 mm high letters
Size 6	25.40 mm x 101.60 mm	1 line	12.70 mm high letters
Size 7	25.40 mm x 101.60 mm	2 lines	6.35 mm high letters

- .2 Labels: embossed plastic labels with 6.35 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages.

## **2.5 Wiring Identification**

- .1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders.
- .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.

## **2.6 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 50 foot intervals.
- .3 Colours: 25.40 mm wide prime colour and 19.05 mm wide auxiliary colour.

	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

## 2.7 Finishes

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

## Part 3 Execution

### 3.1 Installation

- .1 Do complete installation in accordance with the latest edition of the Canadian Electrical Code CSA C22.1 except where specified otherwise.

### 3.2 Nameplates And Labels

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

### 3.3 Location Of Outlets

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 152.40 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3.0480 metres 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.

### 3.4 Mounting Heights

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1200.mm.
  - .2 Wall receptacles:
    - .1 General: 304.80 mm.
    - .2 Above top of continuous baseboard heater: 203.20 mm.
    - .3 Above top of counters or counter splash backs: 152.40 mm.
    - .4 In mechanical rooms: 1371.60 mm.
  - .3 Panelboards: as required by Code or as indicated.
  - .4 Telephone and interphone outlets: 304.80 mm.
  - .5 Wall mounted telephone and interphone outlets: 1524.0 mm
  - .6 Fire alarm stations: 1524.0 mm
  - .7 Fire alarm bells: 2082.80 mm
  - .8 Television outlets: 304.80 mm.
  - .9 Wall mounted speakers: 2082.80 mm.
  - .10 Clocks: 2082.80 mm.
  - .11 Door bell pushbuttons: 1524.0 mm.
  - .12 Barrier Free
    - .1 Local switches – 1219.20 mm
    - .2 Wall receptacles – 457.20 mm
    - .3 Telephone/data – 457.20 mm
    - .4 Wall mount phone – 1219.20 mm
    - .5 Fire alarm pull stations – 1219.20 mm
    - .6 TV outlets – 457.20 mm

### 3.5 Co-ordination Of Protective Devices

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

### 3.6 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 Power distribution system including phasing, voltage, grounding and load balancing.
  - .2 Circuits originating from branch distribution panels.

- .3 Lighting and its control.
- .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
- .5 Systems: fire alarm system, communications, main entry system security.
- .6 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 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

### **3.7 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**

## **Part 1 General**

### **1.1 General Requirements**

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### **1.2 Section Includes**

- .1 Materials and installation for wire and box connectors.

### **1.3 References**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-C22.2No.18-98, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
  - .2 CSA C22.2No.65-93(R1999), Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
  - .1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

## **Part 2 Products**

### **2.1 Materials**

- .1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper aluminum alloy sized to fit copper and aluminum conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 NEMA to consist of:
  - .1 Connector body and stud clamp for stranded, round, copper conductors.
  - .2 Clamp for stranded, round, copper conductors.
  - .3 Stud clamp bolts.
  - .4 Bolts for copper conductors or bar.



- .5 Bolts for aluminum conductors or bar.
- .4 Clamps or connectors for armoured cable, aluminum sheathed cable, flexible conduit, as required to: CAN/CSA-C22.2No.18.

### **Part 3 Execution**

#### **3.1 Installation**

- .1 Remove insulation carefully from ends of conductors and:
  - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
  - .2 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.
  - .3 Install fixture type connectors and tighten. Replace insulating cap.
  - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2 NEMA.

**END OF SECTION**

**Part 1 General**

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**1.2 Product Data**

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

**Part 2 Products**

**2.1 Building Wires**

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper ACM alloy conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE.

**2.2 Teck 90 Cable**

- .1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Conductors:
  - .1 Grounding conductor: copper.
  - .2 Circuit conductors: copper or ACM alloy as indicated, size as indicated.
- .3 Insulation:
  - .1 Cross-linked polyethylene XLPE.
  - .2 Rating: , 600 V.
- .4 Armour: interlocking aluminum.
- .5 Overall covering: thermoplastic polyvinyl chloride.
- .6 Fastenings:
  - .1 One hole zinc straps to secure surface cables 50.80 mm and smaller. Two hole ZINC straps for cables larger than 50.80 mm.
  - .2 Channel type supports for two or more cables at 1.5240 metres centers.

.3 Galvanized threaded rods and fasteners: 6.35 mm diameter to support suspended channels.

.7 Connectors:

.1 Watertight, approved for TECK cable.

## **2.3 Armoured Cables**

.1 Conductors: insulated, aluminum, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Connectors: anti short connectors.

## **2.4 Control Cables**

.1 Type: LVT: 2 soft annealed copper conductors, sized as indicated:

.1 Insulation: thermoplastic.

.2 Sheath : thermoplastic jacket.

## **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 local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

### **3.2 General Cable Installation**

.1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

.2 Cable Colour Coding: to Section 26 05 00 Common Work Results for Electrical.

.3 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

- .6 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 Teck90 Cable (0 -1000 V)**

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

### **3.5 Installation Of Armoured Cables**

- .1 Group cables wherever possible on channels.

### **3.6 Installation Of Control Cables**

- .1 Install control cables in conduit. If low voltage may be run in free air with support as required by the CEC.

**END OF SECTION**

## **Part 1 General**

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### **1.2 References**

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Departmental Representatives (IEEE)
- .2 Canadian Standards Association, (CSA International)

## **Part 2 Products**

### **2.1 Equipment**

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 Copper conductor: minimum 6.0960 metres long for each concrete encased electrode, bare, stranded, [tinned], soft annealed, size [as indicated].
- .3 Rod electrodes: copper clad steel 19.05 mm dia by 3.0480 metres long.
- .4 Plate electrodes: galvanized, surface area .60960 square metre, 1.6 mm thick.
- .5 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .6 Insulated grounding conductors: green, type R90.
- .7 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .8 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1 Grounding and bonding bushings.
  - .2 Protective type clamps.
  - .3 Bolted type conductor connectors.
  - .4 Bonding jumpers, straps.

- .5 Pressure wire connectors.

### **Part 3 Execution**

#### **3.1 Installation General**

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .8 Install separate ground conductor to outdoor lighting standards.
- .9 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .10 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end and load end.

#### **3.2 System And Circuit Grounding**

- .1 Install system and circuit grounding connections to neutral of secondary 208 V system.

#### **3.3 Equipment Grounding**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, elevators, distribution panels, outdoor lighting.

#### **3.4 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 Departmental Representative and local authority having jurisdiction over installation.

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

**END OF SECTION**

## **Part 1        General**

### **1.1        General Requirements**

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## **Part 2        Products**

### **2.1        Support Channels**

- .1        Galvanized U shape, size 41.275 mm, 3.1750 mm thick, surface mounted or suspended.

## **Part 3        Execution**

### **3.1        Installation**

- .1        Secure equipment to solid masonry, surfaces with lead anchors or nylon shields.
- .2        Secure equipment to poured concrete with expandable inserts.
- .3        Do not secure equipment to hollow masonry walls or suspended ceilings.
- .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 zinc straps to secure surface conduits and cables 50.80 mm and smaller.
  - .2        Two-hole zinc straps for conduits and cables larger than 50.80 mm
  - .3        Beam clamps to secure conduit to exposed steel work.
- .7        Suspended support systems.
  - .1        Support individual cable or conduit runs with 6.35 mm dia galvanized threaded rods and spring clips.



- .2 Support 2 or more cables or conduits on channels supported by 6.35 mm dia galvanized threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels at 3.0480 metres on centre spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

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### **1.2 Related Sections**

### **1.3 References**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1, Canadian Electrical Code latest edition, Part 1.

### **1.4 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 the electrical contractor.

## **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 connection blocks to match required size and number of incoming and outgoing conductors as indicated.
- .3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

## **2.2 Junction And Pull Boxes**

- .1 Construction:welded steel enclosure.
- .2 Covers Flush Mounted: 25.40 mm minimum extension all around.
- .3 Covers Surface Mounted: screw-on flat covers.

## **2.3 Cabinets**

- .1 Construction: sheet steel hinged door, latch lock 2 keys and catch
- .2 Type E Empty: surface return flange flush overlapping sides mounting as indicated.
- .3 Type T Terminal: surface return flange mounting as indicated containing sheet steel 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 1.9812 metres 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 as required by CSA C22.1.

### **3.3 Identification**

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

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### **1.2            Related Sections**

### **1.3            References**

- .1        Canadian Standards Association (CSA International)
  - .1        CSA C22.1, Canadian Electrical Code, latest edition, Part 1.

### **1.4            Submittals**

- .1        Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Submit samples for floor box in accordance with Section 01 33 00 - Submittal Procedures.

### **1.5            Delivery, Storage And Handling**

- .1        Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

## **Part 2           Products**

### **2.1           Outlet And Conduit Boxes General**

- .1        Size boxes in accordance with CSA C22.1.
- .2        101.60 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 19.05 mm x 50.80 mm x 38.10 mm or as indicated. 101.60 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 101.60 mm x 50.80 mm x 47.625 mm.
- .4 101.60 mm square or octagonal outlet boxes for lighting fixture outlets.
- .5 Extension and plaster rings for flush mounting devices in finished plaster walls.

## **2.3 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 wiring of devices.

## **2.6 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 31.750 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 6.35 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, armoured cable connections. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

**END OF SECTION**

## **Part 1 General**

### **1.1 General Requirements**

- .1 The General Conditions, the Supplementary Conditions, the Instructions to Bidders and Division One General Requirements shall be read in conjunction with and govern this section.
- .2 The Specification shall be read as a whole by all parties concerned. Each Section may contain more or less than the complete work of any trade. The Contractor is solely responsible to make clear to the Subcontractors the extent of their work.

### **1.2 Related Sections**

### **1.3 References**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
  - .2 CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.
  - .3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.
  - .5 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.

## **Part 2 Products**

### **2.1 Conduits**

- .1 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .4 Rigid pvc conduit: to CSA C22.2 No. 211.2.
- .5 Flexible metal conduit: to CSA C22.2 No. 56, aluminum liquid-tight flexible metal.
- .6 Flexible pvc conduit: to CAN/CSA-C22.2 No. 227.3.

### **2.2 Conduit Fastenings**

- .1 One hole zinc straps to secure surface conduits 50.80 mm and smaller.
  - .1 Two hole zinc straps for conduits larger than 50.80 mm.

- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Galvanized channel type supports for two or more conduits at 25.40 mm on centre.
- .4 Galvanized threaded rods, 6.35 mm diameter, to support suspended channels.

## **2.3 Conduit Fittings**

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified.  
Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25.40 mm and larger conduits.
- .3 Set screw couplings for EMT.

## **2.4 Expansion Fittings For Rigid Conduit**

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 101.60 mm or 203.20 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19.05 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

## **2.5 Pull Cord**

- .1 Polypropylene 6.35 mm.

## **Part 3 Execution**

### **3.1 Manufacturer's Instructions**

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

### **3.2 Installation**

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .3 Surface mount conduits.
- .4 Use rigid hot dipped galvanized steel threaded conduit below 1.5240 metres above finished floor or grade where exposed to physical damage.



- .5 Use electrical metallic tubing (EMT) except in cast concrete above 1.5240 metres not subject to mechanical injury.
- .6 Use rigid pvc conduit underground.
- .7 Use flexible metal conduit for connection to motors in dry areas damp or corrosive locations.
- .8 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .9 Minimum conduit size for lighting and power circuits: 19.05 mm.
- .10 Bend conduit cold:
  - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .11 Mechanically bend steel conduit over 19.05 mm diameter.
- .12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .13 Install pull cord in empty conduits.
- .14 Run 2 of 25.40 mm spare conduits up to ceiling space and 2 of 25.40 mm spare conduits down to ceiling space from each flush panel for each house panel.
  - .1 Terminate these conduits in 152.40 mm x 152.40 mm x 101.60 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.
- .15 Remove and replace blocked conduit sections.
  - .1 Do not use liquids to clean out conduits.
- .16 Dry conduits out before installing wire.

### **3.3 Surface Conduits**

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5240 metres clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members.
- .6 Do not locate conduits less than 76.20 mm parallel to steam or hot water lines with minimum of 25.40 mm at crossovers.

**3.4            Concealed Conduits**

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

**3.5            Cleaning**

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

**END OF SECTION**

**Part 1            General**

**1.1            General Requirements**

- .1        The General Conditions, the Supplementary Conditions, the Instructions to Bidders and Division One General Requirements shall be read in conjunction with and govern this section.
- .2        The Specification shall be read as a whole by all parties concerned. Each Section may contain more or less than the complete work of any trade. The Contractor is solely responsible to make clear to the Subcontractors the extent of their work.

**1.2            Section Includes**

- .1        Switches, receptacles, wiring devices, cover plates and their installation.

**1.3            Related Sections**

- .1        Section 01 33 00 - Submittal Procedures.
- .2        Section 26 05 00 - Common Work Results - Electrical.

**1.4            References**

- .1        Canadian Standards Association (CSA International)
  - .1        CSA-C22.2 No.42-99(R2002), General Use Receptacles, Attachment Plugs and Similar Devices.
  - .2        CSA-C22.2 No.42.1-00, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
  - .3        CSA-C22.2 No.55-M1986(July 2001), Special Use Switches.
  - .4        CSA-C22.2 No.111-00, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

**1.5            Shop Drawings And Product Data**

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

## **Part 2        Products**

### **2.1            Switches**

- .1        Low voltage, push button switches to match existing.
- .2        Switch color to match existing.

### **2.2            Receptacles**

- .1        Duplex receptacles, CSA type 5-15 R and 5-20R, 125 V, 15 A, 20 A U ground, to:  
CSA-C22.2 No.42 with following features:
  - .1        Ivory, high impact resistive nylon top face.
  - .2        Suitable for No. 10 AWG for back and side wiring.
  - .3        Break-off links for use as split receptacles.
  - .4        Eight back wired entrances, four side wiring screws.
  - .5        Triple wipe contacts and rivetted grounding contacts to mounting strap with  
ground screw.
  - .6        Wall plate mount and strap: one piece steel
  - .7        Commercial grade receptacles.
- .2        Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
  - .1        Ivory, high impact resistive nylon top face.
  - .2        Suitable for No. 10 AWG for back and side wiring.
  - .3        Four back wired entrances, 2 side wiring screws.
- .3        Other receptacles with ampacity and voltage as indicated.
- .4        Receptacles of one manufacturer throughout project.

### **2.3            Cover Plates**

- .1        Cover plates for wiring devices to: CSA-C22.2 No.42.1.
- .2        Cover plates from one manufacturer throughout project.
- .3        Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .4        Ivory nylon cover plates for wiring devices mounted in flush-mounted outlet box.
- .5        Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit  
boxes.

**Part 3            Execution**

**3.1                Installation**

- .1        Switches:
  - .1        Install switches in gang type outlet box when more than one switch is required in one location.
  - .2        Mount switches at the same height as existing switches.
- .2        Receptacles:
  - .1        Install receptacles in gang type outlet box when more than one receptacle is required in one location.
  - .2        Mount receptacles at the same height as existing receptacles.
  - .3        Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .3        Cover plates:
  - .1        Protect 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.

**END OF SECTION**

## **Part 1 General**

### **1.1 General Requirements**

- .1 The General Conditions, the Supplementary Conditions, the Instructions to Bidders and Division One General Requirements shall be read in conjunction with and govern this section.
- .2 The Specification shall be read as a whole by all parties concerned. Each Section may contain more or less than the complete work of any trade. The Contractor is solely responsible to make clear to the Subcontractors the extent of their work.

### **1.2 Section Includes**

- .1 Materials for moulded-case circuit breakers for existing panels.

### **1.3 Related Sections**

- .1 Section 01 33 00 - Submittal Procedures.

### **1.4 References**

- .1 Canadian Standards Association (CSA International).
  - .1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

### **1.5 Submittals**

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

## **Part 2 Products**

### **2.1 Breakers General**

- .1 Moulded-case circuit breakers to CSA C22.2 No. 5
- .2 Plug-in moulded case circuit breakers: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
- .5 Circuit breakers to have minimum symmetrical rms interrupting capacity rating as indicated on panel schedules.

- .6 Breakers with interrupting capacity to match existing breakers in existing panels.

## **2.2 Thermal Magnetic Breakers Design A**

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

## **2.3 Current Limiting And Series Rated Thermal Magnetic Breakers Design C**

- .1 Thermal magnetic breakers with current limiters.
  - .1 Time current limiting characteristics of fuses limiters coordinated with time current tripping characteristics of circuit breaker.
  - .2 Co-ordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker.
- .2 Series rated breakers to be manufacturer tested and listed. Breakers to be applied following manufacturer's guidelines and accepted best practice.
  - .1 Breakers applied following manufacturer's guidelines and accepted best practice.

## **Part 3 Execution**

### **3.1 Installation**

- .1 Install circuit breakers as indicated.

**END OF SECTION**