

**Part 1            General**

**1.1            RELATED REQUIREMENTS**

- .1        Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings.

**1.2            REFERENCES**

- .1        Canadian Standards Association (CSA International)
  - .1        CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations, Includes Update No. 1 (2012).
- .2        Ontario Electrical Safety Code, 25th Edition, 2012.

**1.3            DESIGN REQUIREMENTS**

- .1        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.
- .2        .Language operating requirements: provide identification nameplates and labels for control items in English and French.
- .3        Use one nameplate or label for each language.

**1.4            ACTION AND INFORMATIONAL 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 under plexiglass 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 Ontario, 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 on drawings clearances for operation, maintenance, and replacement of operating equipment devices.
  - .5        If changes are required, notify Departmental Representative 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 Electrical Safety Authority for special approval before delivery to site.

- .3 Submit test results of installed electrical systems and instrumentation.
  - .4 Permits and fees.
  - .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.

## **1.5 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of project.
- .2 Construction Waste Management and Disposal: separate waste materials for reuse and recycling.

## **1.7 SYSTEM STARTUP**

- .1 Instruct Departmental Representative 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.

## **1.8 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, lubrication, and shutdown procedures.
    - .3 Safety precautions.
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- .4 Procedures to be followed in event of equipment failure.
- .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.
- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

## **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 Electrical Safety Authority 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.

### **2.3 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 and labels as follows:
  - .1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, black matt finish face, white core, lettering accurately aligned and engraved into core.
  - .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 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, numbered, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

## **2.6 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 15 m intervals.
- .3 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	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

### **3.2 NAMEPLATES AND LABELS**

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

### **3.3 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 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.

### **3.5 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: 300 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: 1200 mm.
    - .3 Panelboards: as required by Code or as indicated.
    - .4 Telephone and interphone outlets: 300 mm.
    - .5 Wall mounted telephone and interphone outlets: 1200 mm.
    - .6 Fire alarm stations: 1200 mm.
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- .7 Fire alarm bells: 2100 mm.
- .8 Television outlets: 300 mm.
- .9 Wall mounted speakers: 2100 mm.
- .10 Clocks: 2100 mm.
- .11 Door bell pushbuttons: 1200 mm.

### **3.6 CO-ORDINATION OF PROTECTIVE DEVICES**

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

### **3.7 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.
    - .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.
  - .4 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
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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.

**3.8****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**

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**Part 1            General**

**1.1                REFERENCES**

- .1        CSA International
  - .1            CAN/CSA-C22.2 No. 65-13, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE).
- .2        Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
  - .1            EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3        National Electrical Manufacturers Association (NEMA)

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.3                CLOSEOUT SUBMITTALS**

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

**1.4                DELIVERY, STORAGE AND HANDLING**

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

**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.
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- .2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
  - .1 Connector body and stud clamp for stranded copper conductors.
  - .2 Clamp for round copper conductor bars.
  - .3 Stud clamp bolts.
  - .4 Bolts for copper conductors.

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Remove insulation carefully from ends of conductors and cables 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 CAN/CSA-C22.2 No.65.
  - .3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
  - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

#### **3.2 CLEANING**

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.

**END OF SECTION**

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**Part 1            General**

**1.1            RELATED REQUIREMENTS**

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

**1.2            REFERENCES**

- .1      CSA C22.2 No. 0.3-09, Test Methods for Electrical Wires and Cables.
- .2      ANSI/UL 2196, Test For Fire Resistive Cable - Electrical Circuit Protective System (FHIT) # 25.
- .3      CSA C22.2 No. 38-14, Thermoset-Insulated Wires and Cables (Tri-national Standard, with UL 44 and ANCE NMJ-J-451-2014).
- .4      CSA Certified Type FAS to CSA STO C22.2 n° 208-03 (R2013), Fire Alarm and Signal Cable.
- .5      CSA C22.1.2-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations, Includes Update No. 1 (2012).
- .6      CSA/ULC S524-06-AM1, Standard for Installation of Fire Alarm Systems, Includes Amendment 1 (Feb 2011).

**1.3            PRODUCT DATA**

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

**1.4            WASTE MANAGEMENT AND DISPOSAL**

- .1      Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .2      Fold up metal banding, flatten and place in designated area for recycling.

**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 thermoplastic insulation type TWN rated at 600 V, 75°C for 208 V circuits and rated for 1000 V, 75°C for 600 V circuits.

**2.2            LIFE SAFETY SYSTEM WIRING**

- .1      Approved MICC wiring for at least the following, and for other installations as required by the National Building Code and other applicable codes:
    - .1      Network cabling between the Fire Alarm Panel, CACF and Transponders/DGPs.
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- .2 Power to Fire Alarm Panel, transponders, annunciators and CACF (Central Alarm and Control Facility).

## **2.3 FIRE ALARM SYSTEMS WIRES**

- .1 Copper conductors with coded PVC insulation and with overall red PVC jacket. Cables shall be CSA approved, FAS 300V, 105°C.
- .2 Conductors shall conform to sized indicated by manufacturer, but in any case, the minimum size of any conductor from transponder cabinet to devices shall be:
  - .1 For alarm receiving circuits # 16 gauge FAS 105. In no case shall the wire resistance in these circuits exceed 50 ohms.
  - .2 For addressable initiate circuits # 18 gauge FAS 105 twisted unshielded conductors run in separate conduit systems.
  - .3 For signal/paging circuits min. # 16 gauge FAS 105 twisted unshielded in separate conduit system. Connect speakers in each area wired for A and B signal circuits.
  - .4 For telephone circuits # 18 gauge FAS 105 shielded twisted pair conductors run in separate conduit system.
  - .5 24 volts power wiring shall be min. # 14 gauge FAS 105.
  - .6 Ground: insulated ground wire FAS 105°C.
- .3 Multiplex risers - # 14 gauge FAS, twisted pair, shielded, RHH single conductor. Cables ULC rated 2 hours.

## **2.4 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, size as indicated.
- .3 Insulation:
  - .1 Cross-linked polyethylene XLPE.
  - .2 Rating: 600 V and 1000 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: flat.
- .6 Fastenings:
  - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
  - .2 Threaded rods: 6 mm diameter to support suspended channels.

## **2.5 MINERAL-INSULATED CABLES**

- .1 Conductors: solid bare soft-annealed copper, size as indicated.

- .2 Insulation: compressed powdered magnesium oxide or silicon dioxide to form compact homogeneous mass throughout entire length of cable.
- .3 Outer covering: annealed seamless stainless steel sheath, Type M1 rated 600 V, 250 degrees C.
- .4 Two hour fire rating.
- .5 Connectors: field installed approved for MI cable.
- .6 Termination kits: field installed approved for MI cable.

## **2.6 ARMOURED CABLES**

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from galvanized steel strip.
- .4 Type: ACWU90 jacket over armour and compliant to applicable Building Code classification for this project wet locations.
- .5 Connectors: anti short connectors.

## **2.7 CABLES AND REELS**

- .1 Provide cables on reels or coils.
  - .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.
- .2 Each coil or reel of cable to contain only one continuous cable without splices.
- .3 Identify cables for exclusively dc applications.
- .4 Reel and mark shielded cables rated 2 kV and above.

## **Part 3 Execution**

### **3.1 FIELD QUALITY CONTROL**

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

### **3.2 GENERAL CABLE INSTALLATION**

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

### **3.3 INSTALLATION OF BUILDING WIRES**

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

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

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

### **3.5 INSTALLATION OF MINERAL-INSULATED CABLES**

- .1 Install cable concealed, securely supported by hangers.
- .2 Support 2 hour fire rated cables at 1 m intervals.
- .3 Make cable terminations by using factory-made kits.
- .4 Cable terminations: use thermoplastic sleeving over bare conductors.
- .5 Where cables are buried in cast concrete or masonry, sleeve for entry and exit of cables.
- .6 Do not splice cables unless indicated.

### **3.6 INSTALLATION OF ARMOURED CABLES**

- .1 Group cables wherever possible on channels.

### **3.7 INSTALLATION OF FIRE ALARM SYSTEM CONDUCTOR**

- .1 All wiring shall be installed in E.M.T. with steel coupling.
- .2 Install wiring in conformance with the requirements of the Canadian Electrical Code, Part I, and applicable Provincial Codes.
- .3 All wiring shall be identified by coded markers at outlets and pull boxes. **Joints shall only be made at device terminals.**
- .4 The wiring of the life safety systems shall be terminated on coded terminal blocks at all junction points. Prepare composite record drawings, in riser form, showing every junction terminal block and identifying all colour and number codes. Submit these drawings with as-built records.
- .5 Install insulated ground wire in each conduit to be terminated in each junction or pull

box. No pass through is acceptable.

- .6 Fire alarm wiring is to be run in continuous lengths from the source enclosure to the field devices, to be free of joints and splices and that all termination's and connection are to take place only at the source enclosure and field devices.

**END OF SECTION**

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**Part 1            General**

**1.1            RELATED SECTIONS**

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

**1.2            REFERENCES**

- .1        CSA International
  - .1        CSA Z32-09, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.4            CLOSEOUT SUBMITTALS**

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

**1.5            DELIVERY, STORAGE AND HANDLING**

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

**Part 2            Products**

**2.1            EQUIPMENT**

- .1        Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
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- .2 Grounding conductors: bare stranded copper, tinned, soft annealed, size as required.
- .3 Insulated grounding conductors: green, copper conductors, size as required.
- .4 Ground bus: copper, size as required, complete with insulated supports, fastenings, connectors.
- .5 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 Thermit welded type conductor connectors.
  - .5 Bonding jumpers, straps.
  - .6 Pressure wire connectors.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

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

#### **3.2 INSTALLATION GENERAL**

- .1 Install complete permanent, continuous grounding system including, 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 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .8 Bond single conductor, metallic armoured cables to cabinet at supply end, and load end.
- .9 Ground secondary service pedestals.



**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, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting, cable trays.

**3.4 FIELD QUALITY CONTROL**

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

**3.5 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 - General Instructions, Part 1.7 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

**Part 1            General**

**1.1                WASTE MANAGEMENT AND DISPOSAL**

- .1        Separate and recycle waste materials.
- .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.
- .4        Divert unused metal materials from landfill to metal recycling facility.
- .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.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Secure equipment to solid masonry, tile and plaster surfaces with lead anchors.
  - .2        Secure equipment to poured concrete with expandable inserts.
  - .3        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.
  - .4        Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
  - .5        Fasten exposed conduit or cables to building construction or support system using straps.
    - .1        One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
    - .2        Two-hole steel straps for conduits and cables larger than 50 mm.
    - .3        Beam clamps to secure conduit to exposed steel work.
  - .6        Suspended support systems.
    - .1        Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
    - .2        Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
  - .7        For surface mounting of two or more conduits use channels at 5m on centre spacing.
-

- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

**END OF SECTION**

**Part 1            General**

**1.1            RELATED SECTIONS**

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

**1.2            REFERENCES**

- .1        Canadian Standards Association (CSA International)
  - .1        CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations, Includes Update No. 1 (2012).

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Product Data:
  - .1        Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4            DELIVERY, STORAGE AND HANDLING**

- .1        Waste Management and Disposal:
  - .1        Separate waste materials for reuse and recycling.

**Part 2           Products**

**2.1            JUNCTION AND PULL BOXES**

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

**Part 3           Execution**

**3.1            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        Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.
-

**3.2 IDENTIFICATION**

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

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations, Includes Update No. 1 (2012).

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.3                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.

**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 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .4 Extension and plaster rings for flush mounting devices in finished plaster walls.

**2.3                CONDUIT BOXES**

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

**2.4            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 35 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 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                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. 45.2-08(2013), Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel (Tri-National Standard, with NMX-J-576-ANCE and UL 6A).
  - .3 CSA C22.2 No. 56-13, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .4 CSA C22.2 No. 83-M1985 (R2013), Electrical Metallic Tubing.
  - .5 CSA C22.2 No. 211.2-06 (R2011), Rigid PVC (Unplasticized) Conduit, Update No. 1 (2011).

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.3                WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling.
- .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 metal conduit: to CSA C22.2 No. 45.2, aluminum threaded.
  - .2 Epoxy coated conduit: to CSA C22.2 No. 45.2, 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, liquid-tight flexible metal.

## **2.2 CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
  - .1 Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 5 m on centre.
- .4 Threaded rods, 6 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 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
  - .1 Set-screws are not acceptable.

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

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 or 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.

# **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 Use rigid aluminum threaded conduit except where specified otherwise.
- .4 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury.
- .5 Use rigid pvc conduit underground.
- .6 Use flexible metal conduit for connection to motors in dry areas, connection to surface or recessed fluorescent fixtures.
- .7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .8 Minimum conduit size for lighting and power circuits: 19 mm.
- .9 Bend conduit cold:
  - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .10 Mechanically bend steel conduit over 19 mm diameter.
- .11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .12 Install fish cord in empty conduits.
- .13 Run 2-25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each flush panel.
  - .1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.
- .14 Remove and replace blocked conduit sections.
  - .1 Do not use liquids to clean out conduits.
- .15 Dry conduits out before installing wire.

### **3.3 SURFACE CONDUITS**

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

### **3.4 CONCEALED CONDUITS**

- .1 Run parallel or perpendicular to building lines.
  - .2 Do not install horizontal runs in masonry walls.
-

- .3 Do not install conduits in terrazzo or concrete toppings.

**3.5 CLEANING**

- .1 Proceed in accordance with Section 01 00 10 - General Instructions, Part 1.7 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

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**Part 1            General**

**1.1            REFERENCES**

- .1    CSA International
  - .1    CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.
  - .2    CAN/CSA C22.2 No.42.1-13, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
  - .3    CSA C22.2 No.55-M1986(R2012), Special Use Switches.
  - .4    CSA C22.2 No.111-10, General-Use Snap Switches (Bi-national standard, with UL 20).

**1.2            ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.3            CLOSEOUT SUBMITTALS**

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

**1.4            DELIVERY, STORAGE AND HANDLING**

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

**Part 2            Products**

**2.1            SWITCHES**

- .1    15 A, 120 V, single pole, switches to: CSA C22.2 No.55 and CSA C22.2 No.111.
-

- .2 Manually-operated general purpose AC switches with following features:
  - .1 Terminal holes approved for No. 10 AWG wire.
  - .2 Silver alloy contacts.
  - .3 Urea or melamine moulding for parts subject to carbon tracking.
  - .4 Suitable for back and side wiring.
  - .5 Ivory toggle.
- .3 Toggle operated fully rated for fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .4 Switches of one manufacturer throughout project.

## **2.2 RECEPTACLES**

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:
  - .1 Ivory urea moulded housing.
  - .2 Suitable for No. 10 AWG for back and side wiring.
  - .3 Break-off links for use as split receptacles.
  - .4 Eight back wired entrances, four side wiring screws.
  - .5 Triple wipe contacts and rivetted grounding contacts.
- .2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
  - .1 Ivory urea moulded housing.
  - .2 Suitable for No. 10 AWG for back and side wiring.
  - .3 Four back wired entrances, 2 side wiring screws.
  - .4 To be used for emergency battery packs.
- .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 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .3 Stainless steel, vertically brushed, 1 mm thick cover plates cover plates, thickness 2.5 mm 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 as indicated.

## **2.4 SOURCE QUALITY CONTROL**

- .1 Cover plates from one manufacturer throughout project.

**Part 3            Execution**

**3.1                INSTALLATION**

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

**3.2                CLEANING**

- .1        Leave Work area clean at end of each day.
- .2        Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

**3.3                PROTECTION**

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

**END OF SECTION**

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**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)
  - .1 ANSI C82.1-04, Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.
- .2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE )
  - .1 ANSI/IEEE C62.41-1991, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
- .3 ASTM International Inc.
  - .1 ASTM F1137-11e1, Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .4 Canadian Standards Association (CSA International)
- .5 ICES-005-07, Radio Frequency Lighting Devices.
- .6 Underwriters' Laboratories of Canada (ULC)

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental Representative.
  - .3 Photometric data to include: spacing criterion.
- .3 Quality assurance submittals: provide following in accordance with Section 01 45 00 - Quality Control.
  - .1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence and cleaning procedures.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Divert unused metal materials from landfill to metal recycling facility.
- .3 Disposal and recycling of fluorescent lamps as per local regulations.
- .4 Disposal of old PCB filled ballasts.

**Part 2 Products**

**2.1 LAMPS**

- .1 Fluorescent lamps to be - T8, 28 Watt, medium bi-pin, rapid-start, 4100 K, 30,000 hour lamp life, 2950 initial lumens, CRI 80; or as indicated.

- .2 Compact fluorescent lamps to be - 18 Watt, G24q-2 base, 12,000 hour lamp life, 12,000 initial lumens, 4100 K, CRI 80; or as indicated.

## **2.2 BALLASTS**

- .1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic.
  - .1 Rating: 120 V, 60 Hz voltage as indicated, for use with 2-28W, rapid start lamps.
  - .2 Totally encased and designed for 40 degrees Celsius ambient temperature.
  - .3 Power factor: minimum 95 % with 95% of rated lamp lumens.
  - .4 Current crest factor: 1.7maximum.
  - .5 Harmonics: 10 % maximum THD.
  - .6 Operating frequency of electronic ballast: 20 kHz minimum.
  - .7 Total circuit power: 56 Watts.
  - .8 Ballast factor: greater than 0.90.
  - .9 Sound rated: Class A.
  - .10 Mounting: integral with luminaire.
- .2 Low pressure sodium ballast:
  - .1 Rating: V, 60 Hz voltage as indicated, for use with 1-35Wlow pressure sodium lamp.

## **2.3 FINISHES**

- .1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

## **2.4 LUMINAIRES**

- .1 As indicated in luminaire schedule.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Locate and install luminaires as indicated.
- .2 Provide adequate support to suit ceiling system.

### **3.2 WIRING**

- .1 Connect luminaires to lighting circuits:
  - .1 Install flexible or rigid conduit for luminaires as indicated.

### **3.3 CLEANING**

- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling.

**END OF SECTION**



**Part 1            General**

**1.1            RELATED SECTIONS**

- .1        Section 26 05 21 – Wires and Cables (0-1000 V).
- .2        Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

**1.2            REFERENCES**

- .1        CSA International
  - .1        CSA C22.2 No.141-10, Emergency Lighting Equipment, Includes Update No. 1 (2011).

**1.3            ACTION AND INFORMATIONAL SUBMITTALS**

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

**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 and with manufacturer's written instructions.
- .2        Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3        Storage and Handling Requirements:
  - .1        Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2        Store and protect emergency lighting from nicks, scratches, and blemishes.
  - .3        Replace defective or damaged materials with new.

**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: 12 or 24 V DC.
  - .4        Operating time: 120 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: quartz halogen.
- .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: white.
- .13 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 EMT, 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 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 are acceptable for emergency lighting installation in accordance with manufacturer's written instructions.
  - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

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

### **3.2 INSTALLATION**

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

### **3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 - General Instructions, Part 1.7 - 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 00 10 - General Instructions, Part 1.7 - Cleaning.

### **3.4 PROTECTION**

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

**END OF SECTION**

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**Part 1            General**

**1.1                REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.2 No.141-10, Emergency Lighting Equipment, Includes Update No. 1 (2011).
  - .2 CSA C860-11, Performance of Internally Lighted Exit Signs, Includes Update No. 1 (2011).
- .2 National Fire Protection Association (NFPA)
  - .1 NFPA 101-2012, Life Safety Code.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.3                WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycle.

**Part 2            Products**

**2.1                STANDARD UNITS**

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860.
  - .2 Housing: cold rolled steel minimum 1.0 mm thick, satin aluminum enamel finish.
  - .3 Face and back plates: die formed cold rolled steel.
  - .4 Lamps: LED-12W, 50,000 hours.
  - .5 Letters: 150 mm high x 19 mm, with 13 mm thick stroke, red on white glass, reading EXIT / SORTIE.
  - .6 Face plate to remain captive for relamping.
  - .7 Supply dual voltage 120 VAC or 24 VDC.
-

**Part 3            Execution****3.1                MANUFACTURER'S INSTRUCTIONS**

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

**3.2                INSTALLATION**

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

**3.3                CLEANING**

- .1        Proceed in accordance with Section 01 00 10 - General Instructions, Part 1.7 - Cleaning.
- .2        On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

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