

## PART 1 - GENERAL

### 1.1 RELATED SECTIONS

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

### 1.2 REFERENCES

- .1 CSA C22.1, Canadian Electrical Code, Part I, Latest 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 Shop drawings:
  - .1 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 coordinated installation.
  - .2 Indicate on drawings, clearances for operation, maintenance, and replacement of operating equipment devices.
  - .3 Submit required copies of 600 x 600 mm minimum size drawings and product data to authority having jurisdiction inspection authorities.
  - .4 If changes are required, notify Consultant of these changes before they are made.
- .3 Quality Control: in accordance with Section 01 45 00 - Quality Control.
  - .1 Provide CSA certified equipment and material.
  - .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction 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 Construction Manager.

#### 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 who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Territorial Act respecting manpower vocational training and qualification.
  - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
  - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 Site Meetings:
  - .1 In accordance with Section 01 31 19 - Project Meetings.
  - .2 Site Meetings: as part of Manufacturer's Field Services described in Part 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
    - .1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
    - .2 Twice during progress of Work at 25% and 60% complete.
    - .3 Upon completion of Work, after cleaning is carried out.

#### 1.7 DELIVERY, STORAGE AND HANDLING

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

#### 1.8 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 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.

## 1.9 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 the following:
  - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
  - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
  - .3 Safety precautions.
  - .4 Procedures to be followed in event of equipment failure.
  - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.
- .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 authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

### 2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

### 2.3 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of Construction Manager.
- .2 Lamicoid signs, minimum size 175 x 250 mm.

## 2.4 WIRING TERMINATIONS

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

## 2.5 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
  - .1 Permanently affixed identification labels/nameplates are required for all electrical equipment. Identification shall be in English.
  - .2 All switchboards, panels, disconnect switches, transformers, control panels, magnetic and manual starters, and time clocks are to be provided with 'Lamicoid' nameplates. Nameplates are to be mechanically affixed to all metal surfaces with metal type "pop rivets" if possible.
  - .3 Nameplates are to be affixed to other surfaces with contact type cement. Contact type cement is to be applied to complete back side of plate, as opposed to several points or locations on same.
  - .4 Nameplates are to be affixed to building exterior surfaces with nylon inserts and self tapping screws unless specifically indicated otherwise.
  - .5 Lamicoid nameplates installed on distribution panelboards, motor control centres, splitter troughs, transformers, shall indicate the following information in the following order:
    - .1 Designated name of equipment.
    - .2 Voltages, number of phases and wires.
    - .3 Designation of power source and circuit #.

### Example:

PANEL N - 150A  
120/208V - 3PH - 4W  
FED FROM PNL CDP-A, CCT #1,3,5

- .6 Lamicoid nameplates installed on combination starters, magnetic starters, manual starters and all various system controls, control panels, and disconnect switches shall contain the following information in the following order:
  - .1 Designated name of equipment.
  - .2 Voltage(s), number of phases and wires.
  - .3 Branch circuit breaker number(s).
- .7 All junction and/or pull boxes shall be marked with an indelible ink marker to designate the circuit number of enclosed wiring, the designated panel name and electrical characteristics where applicable.
- .8 Identify branch circuit wiring including neutral conductors at both ends, including in all junction boxes located in between, with permanent indelible identifying markings, indicating panel and circuit number; i.e. A1-25.
- .9 Install an additional "Lamicoid" nameplate on all, or any piece of electrical equipment, or apparatus, i.e. Main Switchboard, CDP panels,

panelboards, motor control centres, and fusible switches, etc. that may contain overcurrent devices, i.e. circuit breakers and/or fuses, that have been designed for, and incorporate an interrupting capacity sized 'larger" than 10 kAIC.

Example:

- .1 Minimum interrupting capacity of breakers installed in this panel is to be not less than 22 kAIC.
- .2 Minimum interrupting capacity of fuses installed in this MCC is to be not less than 100 kAIC.
- .10 Throughout the building, provide lamicoid nameplates indicating circuit number above all receptacles. Nameplates shall be mechanically fastened to the wall using screws.

2.6 WIRING IDENTIFICATION

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

## 2.7 CONDUIT AND CABLE IDENTIFICATION

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

<i><b>System</b></i>	<i><b>Prime</b></i>	<i><b>Auxiliary</b></i>
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	Green	Blue
Communication Systems		
Fire Alarm	Red	
Emergency	Red	Blue
Voice		
Other		
Security Systems		

## 2.8 FINISHES

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

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.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 Install conduit and sleeves prior to pouring of concrete.
- .1 Sleeves through concrete: schedule 40 steel pipe plastic sheet metal, sized for free passage of conduit, and protruding 50 mm.

- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 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: 1050 mm.
  - .2 Wall receptacles:
    - .1 General: 450 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: 450mm.
  - .5 Wall mounted telephone and interphone outlets: 1200 mm.
  - .6 Fire alarm stations: 1200 mm.
  - .7 Fire alarm bells: 2350 mm.
  - .8 Television outlets: 450 mm.
  - .9 Wall mounted speakers: 2100 mm.
  - .10 Clocks: 2100 mm.
  - .11 Doorbell pushbuttons: 1200 mm.

### 3.6 COORDINATION 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: Measure phase current to panelboards with normal loads operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
  - .1 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
  - .2 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 generation and 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 Insulation resistance testing:
    - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
    - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
    - .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Construction Manager
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 . Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

### 3.8 COORDINATION WITH OTHER TRADES

- .1 Where equipment is to be installed by other trades (i.e., kitchen equipment, mechanical equipment, etc.) and requires electrical connections, ensure a complete seamless job including any final connections and assistance to have all equipment commissioned and operational to the users and consultant's satisfaction.

### 3.9 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 SECTION INCLUDES

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

### 1.2 REFERENCES

- .1 CSA C22.2 No. 65-2013 Wire Connectors

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper alloy aluminum alloy sized to fit copper aluminum conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper alloy 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 aluminum conductors tube bar.
  - .2 Clamp for stranded round copper conductors bar.
  - .3 Clamp for stranded aluminum ACSR conductors round aluminum bar.
  - .4 Stud clamp bolts.
  - .5 Bolts for copper conductors bar.
  - .6 Bolts for aluminum conductors bar.
  - .7 Sized for conductors tubes bars as indicated.
- .4 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.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 C22.2 No.65.
  - .3 Install fixture type connectors and tighten. Replace insulating cap.

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.4      Install bushing stud connectors in accordance with EEMAC 1Y-2  
NEMA.

END OF SECTION

## PART 1 - GENERAL

### 1.1 PRODUCT DATA

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

## PART 2 - PRODUCTS

### 2.1 BUILDING WIRES

- .1 Power feeders and branch circuit wiring shall be RW90-XLPE wire, minimum wire size shall be #12 AWG solid for power and lighting loads, and for continuous loads over 8A. Stranded conductors will be permitted for conductors sized #8 AWG and larger. Minimum wire size for control circuit wiring exceeding 50 volts to ground shall be #14 AWG. Systems rated for 600 volts and less shall have the conductor insulation rated for 600 volts.
- .2 Cables are sized for copper.

### 2.2 ARMOURED CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90; in patient care areas. AC90 to be ISOBX with a #12 AWG Bond wire. No bond smaller than #12 ISO-BX may be used in resident rooms.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Connectors: anti short connectors.

### 2.3 CONTROL CABLES

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

### 2.4 MANUFACTURERS

- .1 Acceptable Manufacturers:
  - .1 Canada Wire and Cable
  - .2 Phillips Cable

- .3     Pireli
- .4     Southwire
- .5     General Cable

### 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 authority having jurisdiction over installation.
- .3     Perform tests before energizing electrical system.

#### 3.2 GENERAL CABLE INSTALLATION

- .1     Install cable in trenches in accordance with Section 33 71 73.02 - Underground Electrical Service.
- .2     Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0-1000 V.
- .3     Cable Colour Coding: to Section 26 05 00 Common Work Results for Electrical.
- .4     Conductor length for parallel feeders to be identical.
- .5     Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .6     Branch circuit work to be RW90 wire in conduit or AC-90 cable where its use is acceptable in accordance with the CEC installed in accordance with the following guidelines:
  - .1     RW90 wire in EMT must be used for all horizontal work above accessible ceilings (T-bar) and where exposed.
  - .2     AC-90 cable may be used for fixture drops, above non-accessible ceilings and in wall partitions. When used for fixture drops install only from junction box to fixture. Loops between fixtures are not acceptable.
  - .3     Maximum exposed length of AC-90 cable from junction box in accessible ceiling is 1500mm.
  - .4     Conduit and armoured cable are to be:
    - .1     Installed concealed in finished areas, parallel and perpendicular to building lines and adequately secured at not less than 1500mm intervals and as required by the CEC or as otherwise indicated, and in a manner to ensure they are protected from potential types of mechanical damage occurring.
    - .2     Installed on independent supports specifically installed for cabling directly from the building structure. In ceiling spaces, do not use supports of other trades. Do not secure cables to mechanical systems piping, ducts, or suspended ceiling support wires.

- .3 Not laid 'un-supported' directly on
- .7 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.
- .8 All wire and cables shall be installed on the warm side of the vapour barrier where possible with vapour barrier penetrations kept to a minimum.
- .9 All cables are to be secured to concrete, concrete block, brick, and metal decking/siding; with inserts complete with self-tapping metal screws. Cables must be installed a minimum of 38mm below the bottom of roof decking. Pliable type cables are to be secured to building structure at 1220mm intervals and tye-wrapped together at mid-point between each structure support.
- .10 Voltage drop: in no instance shall the voltage drop exceed 3% of the line voltage for branch circuit runs. Voltage drop shall be based on the connected load or at 80% of the overcurrent device rating where the load is not known.

### 3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
  - .2 In underground ducts in accordance with Section 33.
  - .3 RW90 in EMT for all horizontal work above accessible ceilings (T-Bar) and where exposed.
  - .4 Feeder conductors are to be installed in Rigid Conduit.

### 3.4 INSTALLATION OF ARMoured CABLES

- .1 Group cables wherever possible on channels.
- .2 Use only for fixture drops, above non-accessible ceilings and in wall partitions.
- .3 When used for fixture drops install only from junction box to fixture. Loops between fixtures are not acceptable
- .4 The exposed length of AC-90 cable from the junction box in an accessible ceiling shall not exceed 1500 mm

### 3.5 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit.
- .2 Ground control cable shield to one end only.

END OF SECTION

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 Materials and installation for connectors and terminations.

### 1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.2 Latest edition
  - .2 CSA C22.2 No.41-M1987(R1999), Grounding and Bonding Equipment.

### 1.3 PRODUCT DATA

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

## PART 2 - PRODUCTS

### 2.1 CONNECTORS AND TERMINATIONS

- .1 Copper long barrel compression connectors to CSA C22.2 No. as required sized for conductors.
- .2 Contact aid for aluminum cables where applicable.
- .3 2 way joint boxes submarine dry location type in accordance with Section 26 05 33 - Raceway and Boxes for Electrical Systems.
- .4 2 way junction boxes with respective pothead for 2, 3, or 4 conductor cables for enclosing stress - cone within with allowance for stress - cone beyond for x- linked polyethylene butyl rubber cable with copper sheath, and overall jacket in accordance with Section 26 05 33 - Raceway and Boxes for Electrical Systems.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2 No.41.

END OF SECTION

## PART 1 - GENERAL

### 1.1 REFERENCES

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
  - .1 ANSI/IEEE 837-1989(R1996), Qualifying Permanent Connections Used in Substation Grounding.
- .2 Canadian Standards Association, (CSA International)

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as indicated to electrically conductive underground water pipe.
- .2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, soft annealed, size as indicated.
- .3 Plate electrodes: copper, surface area 0.2 sq/m, 1.6 mm thick.
- .4 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .5 Bonding and grounding conductors shall be copper with a green insulation covering. Bonding and grounding conductors up to and including #10 AWG shall be solid and have RW90 X-link insulation. For sizes of #8 AWG and larger, stranded TW75 green insulation is acceptable.
- .6 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .7 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.
- .8 All feeders and branch circuit conductors installed in conduits shall include a separate green bond wire, sized in accordance with the CEC, minimum size #14 (solid) AWG except as follows:
  - .1 Where bond wire sizes larger than #14 AWG are required, they are to be increased as required by Table 16A of the CEC, or as otherwise noted.
- .9 Minimum size #14 AWG (solid) green insulated conductors are acceptable for bonding purposes associated with various control systems rated 50 volts or less.

## 2.2 MANUFACTURER

- .1 Acceptable Manufacturers:
  - .1 Burndy Ltd.
  - .2 McGraw - Edison (Canada) Ltd.
  - .3 Erico Inc. - Cadweld Div.
  - .4 Ilsco

## PART 3 - EXECUTION

### 3.1 INSTALLATION GENERAL

- .1 The main service entrance and distribution shall be a solidly grounded system.
- .2 Indicate grounding details on drawings including conductor sizes and insulation type, and the quantity and type of grounding electrodes for the incoming service and distribution transformers.
- .3 All grounding and bonding requirements shall be in accordance with the Canadian Electrical Code, Part 1.
- .4 Bonding and grounding conductors shall be copper with a green insulation covering. Bonding and grounding conductors up to and including #10 AWG shall be solid and have RW90 X-link insulation. For sizes of #8 AWG and larger, stranded TW75 green insulation is acceptable.
- .5 All feeders and branch circuit conductors installed in conduits shall include a separate green bond wire, sized in accordance with the CEC, minimum size #14 (solid) AWG except as follows:
  - .1 Where bond wire sizes larger than #14 AWG are required, they are to be increased as required by Table 16 of the CEC, or as otherwise noted.
- .6 Minimum size #14 AWG (solid) green insulated conductors are acceptable for bonding purposes associated with various control systems rated 50 volts or less.
- .7 Isolated ground systems and/or isolated ground type receptacles shall not be used unless prior approval is obtained from the consultant
- .8 Where structural steel is used as part of the construction, the building steel is to be bonded to ground. The connection of the bonding conductor to the steel shall be by exothermic welding.
- .9 Communication systems such as telephone, data, cable T.V., sound, and fire alarm are to be grounded in accordance with the Canadian Electrical Code, ANSI J 5607 A and manufacturers requirements Provide a minimum #6 AWG green insulated conductor in EMT from the main ground bus to the telephone and cable TV service entrance locations and to the main data communication racks
- .10 Coordinate additional grounding and bonding requirements of communications systems with service provider to ensure compliance.

### 3.2 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 Consultant 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 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by Construction Manager.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

## PART 2 - PRODUCTS

### 2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted, suspended, or set in poured concrete walls and ceilings.

### 2.2 MANUFACTURERS

- .1 Acceptable Manufacturers:
  - .1 B-Line
  - .2 Burndy
  - .3 Unistrut

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Secure equipment to hollow solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Fasten exposed conduit or cables to building construction or support system using straps.

- .1 One-hole malleable iron 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.
- .7 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.
- .8 For surface mounting of two or more conduits use channels at 1.5m on centre spacing. Or spaced according to requirements of materials in use.
- .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 except with permission of other trade and approval of Consultant.
- .13 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 REFERENCES

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-12, Canadian Electrical Code, Part 1, 20th Edition.

### 1.2 SUBMITTALS

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

## 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 turned edge 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 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.

### 3.2 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

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## PART 1 - GENERAL

### 1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
- .1 CSA C22.1, Canadian Electrical Code, Part 1, Latest Edition in force.

## PART 2 - PRODUCTS

### 2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

### 2.2 GALVANIZED STEEL OUTLET BOXES

- .1 One-piece electro-galvanized construction.
- .2 Single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .4 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .5 Extension and plaster rings for flush mounting devices in finished plaster tile walls.

### 2.3 MASONRY BOXES

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

### 2.6 CONDUIT BOXES

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

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## 2.8 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.
- .5 Extension rings to be installed on devices on exterior walls as required.

## 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.
- .7 Extension rings to be installed on devices on exterior walls 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-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.
  - .6 CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

## PART 2 - PRODUCTS

### 2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel hot dipped galvanized steel threaded.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings with expanded ends.
- .3 Rigid pvc conduit: to CSA C22.2 No. 211.2.
- .4 Flexible metal conduit: to CSA C22.2 No. 56, steel aluminum liquid-tight flexible metal.

### 2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits NPS 2 and smaller.
  - .1 Two hole steel straps for conduits larger than NPS 2.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at code rated spacing 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 NPS 1 25 mm and larger conduits.
- .3 Connectors and Couplings: Steel setscrew type. Watertight connectors and couplings where moisture may be present.

#### 2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

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

#### 2.5 FISH CORD

- .1 Polypropylene.

#### 2.6 MANUFACTURER

- .1 Acceptable Manufacturers:
  - .1 Alcan Canada
  - .2 Scepter Mfg. Co.
  - .3 Steel Co. of Canada
  - .4 Cooper Crouse-Hinds

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- .1 Where conduit is used for interior wiring it shall be in EMT, except where prohibited by code, unless noted otherwise. Panel feeders must be installed in conduit. Branch circuit power and lighting circuits, fire alarm, security and sound systems, communications and control wiring may be installed in conduit. All conduits shall be concealed except in electrical or mechanical rooms. Conduits shall be run parallel and perpendicular to building lines.
- .2 EMT connectors and couplings shall be the steel setscrew type. Where the probability of moisture exists, steel compression type fittings are acceptable or PVC conduit may be substituted provided it is installed in accordance with the latest Edition of the NBC. Aluminum conduits are not acceptable. Concrete embedded and under ground floor slab conduit shall be PVC or rigid conduit. Solvent cement for PVC duct joints to have a VOC content which meets or exceeds SCAQMD.
- .3 Flexible metal conduit, liquid tight flexible metal conduit and armoured cable are acceptable for short drops to motors, ceiling mounted equipment, etc. Anti-short insulators are required at each termination.
- .4 All EMT stubs are to be bonded to ground in accordance with the CEC.
- .5 Where metal type Q-Deck is being used, all conduits are to be installed on room sides of upper portions of same (directly above tops of, and at right angles to steel joists) and secured directly to sides of metal flutes and/or structure except for roofs. For roofs, conduits must be installed 38mm from bottom of decking in accordance with New Brunswick Electrical Inspection Bulletin No.2-1-10.
- .6 All conduits to be installed on the warm side of the vapour barrier where possible with vapour barrier penetrations kept to a minimum.

- .7 Conduit Fastenings shall be:
  - .1 One hole steel straps to secure surface conduits 53mm and smaller. Two hole steel straps for conduits larger than 53mm.
  - .2 Beam clamps to secure conduits to exposed steel work.
  - .3 Channel type supports for two or more conduits spaced at 1.5m o.c.; minimum 6mm diameter threaded rods to support suspended channels.
- .8 Conduit Fittings shall be:
  - .1 Fittings manufactured for use with conduit specified Coating shall be same as conduit
  - .2 Factory LBs where 90 deg bends are required for conduits larger than 40mm.
  - .3 Fish Cord shall be polypropylene.

### 3.2 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

### 3.3 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

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## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 Materials and installation for standard and custom breaker type panelboards.

### 1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.2 No.29-M1989(R2000), Panelboards and enclosed Panelboards.

### 1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

## PART 2 - PRODUCTS

### 2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
  - .1 Install circuit breakers in panelboards before shipment.
  - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 208/600 V panelboards: bus and breakers rated for 10kA/14kA (symmetrical), respectively interrupting capacity or as indicated.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Two keys for each panelboard and key panelboards alike.
- .6 Copper or Aluminum bus with neutral of same ampere rating as mains.
- .7 Mains: suitable for bolt-on breakers.
- .8 Trim with concealed front bolts and hinges.
- .9 Trim and door finish: baked grey enamel air dried grey enamel as per colour schedule.
- .10 Door: Key locked, c/w 2 keys. All panelboards shall be keyed alike.
- .11 Allow 25% space in all types of panelboards for future growth.

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- .12 Where more than one bonding terminal strip is present in any one panelboard, both shall be hard-wired together using identical size bonding conductor as the one accompanying the panel feeder conductors.
- .13 Where two panels serve the same area they are to be bonded together using #6 AWG minimum.

## 2.2 BREAKERS

- .1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers. Bolt-on type.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker (where shown): separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Departmental Representative.
- .5 Lock-on devices for circuits supplying safety equipment (i.e. fire alarm, emergency, door supervisory, intercom, stairway, exit and night light circuits).
- .6 All panelboards shall have bolt on breakers.

## 2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

## 2.4 MANUFACTURER

- .1 Acceptable Manufacturers:
  - .1 Eaton
  - .2 Schnieder
  - .3 Siemens

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Mount panelboards to height specified in Section 26 05 00 - Common Work Results - Electrical or as indicated.
- .3 Connect loads to circuits.

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- .4      Connect neutral conductors to common neutral bus with respective  
neutral identified

END OF SECTION

## GENERAL

### 1.1 SECTION INCLUDES

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

### 1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
  - .1 CSA-C22.2 No.42-99(R2004), 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 2003), Special Use Switches.
  - .4 CSA-C22.2 No.111-00, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

### 1.3 SHOP DRAWINGS AND PRODUCT DATA

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

### 1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

## PART 2 - PRODUCTS

### 2.1 SWITCHES

- .1 15 A, 120 V, single pole, double pole, three-way, four-way 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 White toggle.
- .3 Toggle operated locking fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .4 Switches of one manufacturer throughout project.

- .5 Acceptable materials: Commercial grade. See table below for acceptable products.

## 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 White 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 White urea moulded housing.
  - .2 Suitable for No. 10 AWG for back and side wiring.
  - .3 Four back wired entrances, 2 side wiring screws.
- .3 Duplex receptacles for cleaning equipment, CSA type 5-20 R, 125 V, combination 15/20 A, U ground, to: CSA-C22.2 No.42 with following features:
  - .1 White 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.
- .4 15A, 120V receptacles located within 1.5m of a sink or washbasin shall be GFCI protected.
- .5 120V exterior duplex receptacles shall be GFCI protected c/w lockable cover.
- .6 Other receptacles with ampacity and voltage as indicated.
- .7 Receptacles of one manufacturer throughout project.
- .8 Acceptable materials: Commercial grade receptacles except as indicated. See table below for acceptable products.

## 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 White nylon cover plates, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.

- .5 Sheet metal cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .6 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

2.4 ACCEPTABLE WIRING DEVICES

.1 Table of wiring devices

ITEM	DESCRIPTION	MANUFACTURER	PART NO.	MANUFACTURER	PART NO.	MANUFACTURER	PART NO.	NOTES
LED DIMMER	600W 120V	LEVITON	IPE04-1 LZ (elv)	HUBBELL	S13I	ARROW HART	RF9537	DECORA STYLE USE ON LED A RETROFIT LAMP
RECEPTACLE	15A 120V	LEVITON	CR15-W	HUBBELL	BR15WI	ARROW HART	BR15	STANDARD STYLE SPEC. GRADE
T SLOT RECEPT	15/20 120V	LEVITON	CR20-W	HUBBELL	BR20WHI	ARROW HART	BR20	STANDARD STYLE
RECEPTACLE GFI	15A 120V	LEVITON	8599	HUBBELL	GF15WLA	ARROW HART	VGf15F	STANDARD STYLE SPEC. GRADE
RECEPTACLE T SLOT GFI	15/20A 120V	LEVITON	N7899	HUBBELL	GF20WLA	ARROW HART	VFGF20	
EXTERIOR GFI 120V	15A 120V	LEVITON	N7599	HUBBELL	GFTR15W	ARROW HART	WRBR15	PROTECTED WHEN OPENED
LIGHTING TOGGLE SW	15A 120V	LEVITON	1201	HUBBELL	1201W	ARROW HART	AH1201	
LIGHTING 3 WAY	15A 120V	LEVITON	1203	HUBBELL	1203W	ARROW HART	AH1203	
LIGHTING 4 WAY	15A 120V	LEVITON	1204	HUBBELL	1204W	ARROW HART	AH1204	
LIGHTING MOTION	15A 120V	LEVITON	ODS10/1 5	HUBBELL	WS120W	ARROW HART	VSIRO4	

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 01 - Common Work Results - Electrical as indicated.

.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 01 - Common Work Results - Electrical as indicated.

.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 SECTION INCLUDES

- .1 Materials for moulded-case circuit breakers.

### 1.2 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).

### 1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include time-current characteristic curves for breakers with ampacity of 400A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

### 1.4 WASTE MANAGEMENT AND DISPOSAL

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

## PART 2 - PRODUCTS

### 2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers, Circuit breakers, and Ground-fault circuit-interrupters, Fused circuit breakers, and Accessory high-fault protectors: to CSA C22.2 No. 5
- .2 Bolt-on moulded case circuit breaker: 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.
  - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .5 Circuit breakers with interchangeable trips as indicated.
- .6 Circuit breakers to have minimum symmetrical rms interrupting capacity rating.

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## 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.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Install circuit breakers as indicated

END OF SECTION

## PART 1 - GENERAL

### 1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 2 1 - Construction/Demolition Waste Management And Disposal.
- .3 Section 01 45 00 - Quality Control.
- .4 Section 26 05 00 - Common Work Results - Electrical

### 1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-C22.2 No.144-M91(R2006), Ground Fault Circuit Interrupters.
- .2 National Electrical Manufacturers Association (NEMA)
  - .1 NEMA PG 2.2-1999, Application Guide for Ground Fault Protection Devices for Equipment.

### 1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

### 1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- .1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA-C22.2 No.144 NEMA PG 2.2.
- .2 . Components comprising ground fault protective system to be of same manufacturer.

### 2.2 BREAKER TYPE GROUND FAULT INTERRUPTER

- .1 Single or Two pole ground fault circuit interrupter for 15 A, 120 V, 1 phase circuit c/w test and reset facilities.

### 2.3 MANUFACTURERS

- .1 . Acceptable Manufacturers:
  - .1 Arrow Hart
  - .2 Hubbell
  - .3 Leviton

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical and co-ordinate with Section 01 45 00 - Quality Control if required.
- .2 Arrange for field testing of ground fault equipment before commissioning service.
- .3 Demonstrate simulated ground fault tests.

END OF SECTION

## PART 1 - GENERAL

### 1.1 REFERENCES

- .1 Canadian Standards Association (CSA International).
- .1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.
- .2 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

### 1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

### 1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Separate for reuse and recycling and place in designated containers Steel Metal Plastic waste in accordance with Waste Management Plan.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

## PART 2 - PRODUCTS

### 2.1 DISCONNECT SWITCHES

- .1 Fusible, or non-fusible, horsepower rated disconnect switch in CSA Enclosure 1, to CAN/CSA C22.2 No.4 size as indicated.
- .2 Provision for padlocking in on-off switch position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size as indicated or as recommended by manufacture.
- .5 Fuseholders: to CSA C22.2 No.39relocatable and suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 ON-OFF switch position indication on switch enclosure cover.

### 2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

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.2 Indicate name of load controlled on size 4 nameplate.

### 2.3 MANUFACTURER

.1 Acceptable Manufacturers:

- .1 Eaton
- .2 Schneider
- .3 Siemens

## PART 3 - EXECUTION

### 3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

## PART 1 - GENERAL

### 1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
- .1 C22.2 No. 9.0-96 (R2011), General Requirements for Luminaires.
- .2 C866-12, Performance of LED luminaires.

### 1.2 SHOP DRAWINGS

- .1 Submit shop drawings.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- .1 Luminaires to have field replaceable LED boards and drivers.
- .2 Five year LED and driver warranty.

### 2.2 ACCEPTABLE MANUFACTURERES

- .1 Refer to lighting schedule on Drawing for fixture information.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Locate and install luminaires as indicated.

### 3.2 WIRING

- .1 Connect luminaires to lighting circuits as indicated.

### 3.3 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations support luminaires independently of ceiling or support luminaires from ceiling grid in accordance with local inspection requirements.

### 3.4 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

END OF SECTION

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

- .1 Materials and installation for emergency lighting systems.

### 1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.2 No.141-M1985(R1999), Unit Equipment for Emergency Lighting.

### 1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

### 1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Fold up metal banding, flatten and place in designated area for recycling.

### 1.5 WARRANTY

- .1 For batteries, the 12 months warranty period prescribed in subsection GC32.1 of General Conditions "C" is extended to 120 months, with no-charge replacement during the first 5 years and pro-rate charge on the second 5 years.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT

- .1 Emergency lighting equipment: to CSA C22.2 No.141.
- .2 Supply voltage: 120V, ac.
- .3 Output voltage: 12V dc.
- .4 Operating time: 60 min.
- .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 0.01V 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, life expectancy 100,000 hours minimum for 'AC Power ON' and 'High Charge'.
- .10 Dual Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: mini halogen, 8W.
- .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 baked enamel.
- .13 Auxiliary equipment:
  - .1 Test switch.
  - .2 Battery disconnect device.
  - .3 AC input and DC output terminal blocks inside cabinet.
  - .4 Auto-test self diagnostics.

## 2.2 WIRING

- .1 Conduit: EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Conductors: RW90 in accordance with Section 26 05 21 - Wires and Cables 0-1000 V, sized as indicated in accordance with manufacturer's recommendations, minimum size is #12 AWG.

## 2.3 MANUFACTURER

- .1 See lighting schedule on electrical drawings for approved manufacturers.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Install wall mounted units 2400 mm from finished floor or at ceiling level when floor to ceiling height is less than 2400 mm.
- .2 Install units as indicated.
- .3 Direct heads as indicated.
- .4 Test each unit for 60 minutes on emergency.

END OF SECTION

## PART 1 - GENERAL

### 1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.2 No.141-02, Unit Equipment for Emergency Lighting.
  - .2 CSA C860-01(December 2002), Performance of Internally-Lighted Exit Signs.

### 1.2 SUBMITTALS

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

### 1.3 WASTE MANAGEMENT AND DISPOSAL

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

## PART 2 - PRODUCTS

### 2.1 STANDARD UNITS

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860.
- .2 Housing: extruded aluminum housing, brush aluminum finish.
- .3 Face and back plates: extruded aluminum.
- .4 Lamps: LED
- .5 Operation: designed for 100,000 hours of continuous operation without re-lamping.
- .6 Pictogram per 2010 national building code.
- .7 Mounting and directional arrows as indicated.
- .8 Downlight: white glass translucent acrylic in bottom of unit.

### 2.2 LUMINAIRES

- .1 As indicated on lighting fixture schedule on drawings.

### 2.3 MANUFACTURER

- .1 See lighting schedule on electrical drawings for approved manufacturers.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Install exit signs to manufacturer's recommendations, listing requirements, NFPA standards and local regulatory requirements.

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- .2 Connect fixtures to exit light circuits.
- .3 Test exit lights on emergency power.
- .4 Ensure that exit light circuit breaker is locked in 'ON' position.

### 3.2 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