

PART 1 GENERAL

1.1 Related Sections

- .1 Section 26 05 00 Common Work Results - Electrical
- .2 Section 26 05 20 Wire and Box Connectors (0-1000V)
- .3 Section 26 05 21 Wires and Cables (0-1000V)
- .4 Section 26 05 28 Grounding - Secondary
- .5 Section 26 05 29 Hangers and Supports for Electrical Systems
- .6 Section 26 05 31 Splitters Junction Pull Boxes and Cabinets
- .7 Section 26 05 32 Outlet Boxes Conduit Boxes and Fittings
- .8 Section 26 05 34 Conduits, Conduit Fastenings and Conduit Fittings
- .9 Section 26 05 44 Installation of Cables in Trenches and in Ducts
- .10 Section 26 09 24 Lighting Control Devices - Low Voltage
- .11 Section 26 12 17 Dry Type Transformers Up to 600V Primary
- .12 Section 26 24 17 Panelboards Breaker Type
- .13 Section 26 27 26 Wiring Devices
- .14 Section 26 28 14 Fuses
- .15 Section 26 28 20 Ground Fault Circuit Interrupters - Class A
- .16 Section 26 28 21 Moulded Case Circuit Breakers
- .17 Section 26 28 23 Disconnect Switches - Fused and Non-fused
- .18 Section 26 29 10 Motor Starters to 600V
- .19 Section 26 50 00 Lighting
- .20 Section 26 52 01 Unit Equipment for Emergency Lighting
- .21 Section 26 53 00 Exit Signs
- .22 Section 27 05 28 Pathways for Communications Systems
- .23 Section 28 31 00.02 Multiplex Fire Alarm and Voice Communication Systems

## 1.2 References

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24<sup>th</sup> Edition), Safety Standard for Electrical Installations.
  - .2 CAN3-C235-83(R2015), Preferred Voltage Levels for AC Systems, 0 to 50,000V.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
  - .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
  - .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

## 1.3 Definitions

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

## 1.4 Design Requirements

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
  - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English.

## 1.5 Submittals

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS in accordance with Section 01 47 15 -

Sustainable Requirements: Construction and Section 02 61 33 - Hazardous Materials.

- .3 Submit for review single line electrical diagrams under Plexiglas in glazed frames and locate as indicated:
  - .1 Electrical distribution system in main electrical room.
- .4 Shop drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Nova Scotia, 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 of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .5 Quality Control: in accordance with Section 01 45 00 - Quality Control.
  - .1 Provide CSA certified equipment and material.
  - .2 Submit test results of installed electrical systems and instrumentation.
  - .3 Permits and fees: in accordance with General Conditions of contract.
  - .4 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
  - .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

- .6 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within ten days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

### 1.6 Quality Assurance

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.
  - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
  - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 Site Meetings:
  - .1 In accordance with Section 01 32 17 - Construction Progress Schedule.
- .4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

### 1.7 Delivery, Storage and Handling

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within ten weeks after award of Contract.
- .2 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 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.

PART 2 PRODUCTS

2.1 Sustainable Requirements

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

2.2 Materials and Equipment

- .2 Do verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

- .1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Material and equipment to be CSA certified.
- .3 Factory assemble control panels and component assemblies.
- .4 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 Sections 26 05 21 - Wires and Cables (0 - 1000V) and 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings, 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 authority having jurisdiction.

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 Nameplates: lamicoid black face, white core, lettering accurately aligned and engraved into core mechanically attached with pop rivets.
  - .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.

2.6 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.

	<u>Prime</u>	<u>Auxiliary</u>
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue

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 to EEMAC 2Y-1.

PART 3 EXECUTION

3.1 Installation

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do 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, sized for free passage of conduit, and protruding 50mm.

- .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 door.

### 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. Install electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1219 mm.
  - .2 Wall receptacles:
    - .1 General: 457 mm.
    - .2 Above top of continuous baseboard heater: 200 mm.
    - .3 Above top of counters or counter splash backs: 153 mm.
    - .4 In mechanical rooms: 1219 mm.
  - .3 Panelboards: as required by Code or as indicated.
  - .4 Telephone and interphone outlets: 457 mm.
  - .5 Wall mounted telephone and interphone outlets: 1219 mm.

- .6 Doorbell pushbuttons: 1219 mm.
- .3 Co-Ordination of Protective Devices
- .4 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.
- .5 Field Quality Control
- .6 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.
- .7 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 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.
- .8 Carry out tests in presence of Departmental Representative.

- .9 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .10 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.
- .11 Cleaning
- .12 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .13 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

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END OF SECTION

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PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 74 21 -  
Construction/Demolition Waste  
Management and Disposal.

1.2 References

- .1 Canadian Standards Association (CSA  
International)
  - .1 CAN/CSA-C22.2No.18.1-04(R2009),  
Outlet Boxes, Conduit Boxes,  
Fittings and Associated  
Hardware.
  - .2 CSA C22.2No.65-03(R2008), Wire  
Connectors.
- .2 Electrical and Electronic  
Manufacturers' Association of Canada  
(EEMAC)
  - .1 EEMAC 1Y-2, 1961 Bushing Stud  
Connectors and Aluminum Adapters  
(1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers  
Association (NEMA)

Waste Management  
1.3 and Disposal

- .1 Separate and recycle waste materials  
in accordance with Section 01 74 19 -  
Construction/Demolition Waste  
Management and Disposal.
- .2 Remove from site and dispose of all  
packaging materials at appropriate  
recycling facilities.
- .3 Collect and separate plastic, paper  
packaging and corrugated cardboard in  
accordance with Waste Management Plan.
- .4 Divert unused wiring materials from  
landfill to metal recycling facility  
as approved by Departmental  
Representative.

PART 2 PRODUCTS

2.1 Materials

- .1 Pressure type wire connectors to: [CSA  
C22.2No.65], with current carrying

- parts of copper alloy sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2No.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 to consist of:
  - .1 Connector body and stud clamp for stranded copper conductors.
  - .2 Clamp for stranded copper conductors.
  - .3 Stud clamp bolts.
  - .4 Bolts for copper conductors.
  - .5 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable, flexible conduit, as required to: CAN/CSA-C22.2No.18.

### PART 3 EXECUTION

#### 3.1 Installation

- .1 Remove insulation carefully from ends of conductors and:
  - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.
  - .2 Install fixture type connectors and tighten. Replace insulating cap.
  - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000V.

1.2 References

- .1 CSA C22.2 No. 0.3-09, Test Methods for Electrical Wires and Cables.
- .2 CSA C22.2 No. 131-07, Type TECK 90 Cable.

1.3 Product Data

- .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 19 - Construction/Demolition Waste Management and Disposal, and with the Waste Reduction Workplan.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3 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 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

2.2 Teck Cable

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
  - .1 Grounding conductor: copper.

- .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
  - .1 Chemically cross-linked thermosetting polyethylene rated type RW90, 600V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: flat, interlocking, galvanized steel.
- .6 Overall covering: polyvinyl chloride material.
- .7 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 Channel type supports for two or more cables.
  - .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors:
  - .1 Watertight, approved for TECK cable.

### 2.3 Armoured Cables

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.

## PART 3 EXECUTION

### 3.1 Installation of Building Wires

- .1 Install wiring as follows:
  - .1 In conduit systems in accordance with Section 26 05 34.

### 3.2 Installation Of Teck Cable 0 -1000 V

- .1 Install cables.
  - .1 Group cables wherever possible on channels.

3.3 Installation of  
Armoured Cables

- .2 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - 0 - 1000 V.
- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.
- .3 Armoured cable only permitted for final vertical connections to lighting fixtures.

END OF SECTION

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PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 74 21 -  
Construction/Demolition Waste  
Management and Disposal.
- .2 Section 26 05 00 - Common Work Results  
- Electrical.

1.2 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)

1.3 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 plastic, paper  
packaging and corrugated cardboard in  
accordance with Waste Management Plan.
- .4 Divert unused metal materials from  
landfill to metal recycling facility  
as approved by Departmental  
Representative.
- .5 Fold up metal banding, flatten and  
place in designated area for  
recycling.

PART 2 PRODUCTS

2.1 Equipment

- .1 Clamps for grounding of conductor:  
size as required to electrically  
conductive underground water pipe.

- .2 Grounding conductors: bare stranded copper, [tinned], soft annealed, size [as indicated].
- .3 Insulated grounding conductors: green, type TW.
- .4 Ground bus: copper, size as indicated, 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 Installation General

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run bond wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, using permanent mechanical connectors.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at both end[s] to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

3.2 System and  
Circuit Grounding

- .1 Install system and circuit grounding connections to neutral of primary 347/600V system, secondary 120/208V system.

3.3 Equipment Bonding

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

3.4 Grounding Bus

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room.
- .2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size as indicated on drawings.

3.5 Communication Systems

- .1 Install grounding connections for telecommunication systems as indicated on the drawings.

3.6 Field Quality Control

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

END OF SECTION



PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 74 21 -  
Construction/Demolition Waste  
Management And Disposal.

1.2 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 plastic, paper  
packaging and corrugated cardboard in  
accordance with Waste Management Plan.
- .4 Divert unused metal materials from  
landfill to metal recycling facility  
as approved by Departmental  
Representative.
- .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 or suspended.

PART 3 EXECUTION

3.1 Installation

- .1 Secure equipment to hollow or 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 with toggle bolts.

- .4 Do not use supports or equipment installed for other trades 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 diameter threaded rods and spring clips.
  - .2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.
- .7 For surface mounting of two or more conduits use channels.
- .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 For conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance

- with manufacturer's installation  
recommendations.
- .13 Do not support any installation  
directly from plasterboard  
installation.

END OF SECTION

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PART 1 GENERAL

1.1 Shop Drawings  
and Product Data

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

1.2 Waste Management  
and Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal, and with the Waste Reduction Workplan.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 Junction and  
Pull Boxes

- .1 Welded steel construction with screw-on flat covers for surface mounting.
- .2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.
- .3 All outdoor junction boxes shall be rated CSA type 4X.

PART 3 EXECUTION

3.1 Junction, Pull  
Boxes and Installation

- .1 Install pull boxes in inconspicuous but accessible locations.

3.2 Identification

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Install size 2 identification labels indicating system name, voltage and phase.
- .3 Junction and pull boxes which contain branch circuit wiring and which are located above finished ceilings, are to have the branch circuit number(s) neatly identified on the cover plate. Felt tip marker may be used for this purpose.

END OF SECTION

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PART 1 GENERAL

1.1 References

- .1 CSA C22.1-2018, Canadian Electrical Code, Part 1.

1.2 Waste Management and Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal, and with the Waste Reduction Workplan.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

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 for special devices.
- .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 Sheet Steel Outlet Boxes

- .1 Electro-galvanized steel 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.

- .2 Electro-galvanized steel 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.
- .4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

### 2.3 Masonry Boxes

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

### 2.4 Concrete Boxes

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

### 2.5 Conduit Boxes

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

### 2.6 Fittings - General

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 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 tile 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. Reducing washers are not allowed.

END OF SECTION

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## PART 1 GENERAL

### 1.1 References

- .1 Canadian Standards Association (CSA)
  - .1 CAN/CSA C22.2 No. 18-98, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
  - .2 CSA C22.2 No. 45-M1981(R1992), Rigid Metal Conduit.
  - .3 CSA C22.2 No. 56-1977(R1999), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
  - .4 CSA C22.2 No. 83-M1985(R1999), Electrical Metallic Tubing.
  - .5 CSA C22.2 No. 211.2-M1984(R1999), Rigid PVC (Unplasticized) Conduit.
  - .6 CAN/CSA C22.2 No. 227.3-M91(R1999), Flexible Nonmetallic Tubing.

### 1.2 Waste Management and Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal, and with the Waste Reduction Workplan.
- .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.
- .4 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

## PART 2 PRODUCTS

### 2.1 Conduits

- .1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

- .3 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .4 Flexible metal conduit: to CSA C22.2 No. 56, aluminum and liquid-tight flexible metal.

## 2.2 Conduit Fastenings

- .1 One hole steel straps to secure surface conduits 50 mm and smaller. 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.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

## 2.3 Conduit Fittings

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90E bends are required for 25 mm and larger conduits.
- .3 Set screw connectors and couplings for EMT.

## 2.4 Fish Cord

- .1 Polypropylene.

## PART 3 EXECUTION

### 3.1 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, electrical service rooms and in unfinished areas.
- .3 Use electrical metallic tubing (EMT) except in cast concrete.
- .4 Use rigid PVC conduit underground.

- .5 Use flexible metal conduit or cable for connection to motors in dry areas, connection to recessed luminaires without a prewired outlet box, connection to surface or recessed LED luminaires.
- .6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .7 Minimum conduit size for lighting and power circuits: 21 mm.
- .8 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .9 Mechanically bend steel conduit over 21 mm dia.
- .10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .11 Install fish cord in empty conduits.
- .12 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .13 Dry conduits out before installing wire.

### 3.2 Surface Conduits

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

### 3.3 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.

### 3.4 Conduits In Cast -In-Place Concrete

- .1 Locate to suit reinforcing steel. Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.
- .5 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

### 3.5 Conduits In Cast -In-Place Slabs On Grade

- .1 Run conduits 25 mm and larger below slab and encased in 50 mm of sand.

3.6 Conduits  
Underground

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

END OF SECTION

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PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Section 26 05 00 - Common Work Results - Electrical.

1.2 References

- .1 Canadian Standards Association, (CSA International)
- .2 Insulated Cable Engineers Association, Inc. (ICEA)

1.3 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 Markers

- .1 Under Ground Cable Markers: as indicated, with words similar to: "Under Ground Electrical Cable(s)".

PART 3 EXECUTION

3.1 Cable Installation In Ducts

- .1 Install cables as indicated in ducts.
  - .1 Do not pull spliced cables inside ducts.
- .2 Install multiple cables in duct simultaneously.

- .3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .6 After installation of cables, seal duct ends with duct sealing compound.

### 3.2 Field Quality Control

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-acceptance tests.
  - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 500 V megger on each phase conductor.
  - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.

- .7 Remove and replace entire length of cable  
if cable fails to meet any of test  
criteria.

END OF SECTION

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PART 1 GENERAL

1.1 Submittals

- .1 Shop Drawings:
  - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Closeout Submittals:
  - .1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Test reports:
  - .2 Submit certified test reports indicating compliance with specifications for specified performance characteristics and physical properties.
  - .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Manufacturer's Instructions: submit manufacturer's installation instructions.
- .5 Manufacturer's Field Reports: manufacturer's field reports specified.

1.2 Delivery, Storage,  
and Handling

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .3 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

- .4 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .5 Divert unused wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

PART 2 PRODUCTS

2.1 Materials

- .1 Control system: by one manufacturer and assembled from compatible components.

2.2 Remote Control Stations

- .1 Single pole, double throw, momentary contact, rated 25V, centre pivot rocker action. Complete with on/off/dimming or occupancy sensor, as indicated on floor plans.

2.3 Low Voltage Relays

- .1 Electrically operated by momentary impulse, mechanically latched until activated.
- .2 Operating voltage: 24V, rectified AC.
- .3 Load contacts: 20A, 347V, AC.

2.4 Occupancy, Daylight Sensors and Power Packs

- .1 Sensors
  - .1 Refer to electrical drawings.
  - .2 All sensors shall be capable of operating normally with electronic drivers, and rated motor loads.
  - .3 Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
  - .4 All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity.

- Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
- .5 In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
  - .6 All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.
  - .7 Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable. Optionally, a BACnet interface may be provided.
  - .8 All sensors shall be installed to meet minimum coverage distances and as per the published manufacturer data. Sensors to be fully coordinated with other adjacent services (i.e. air vents, lights, etc.) conducive to optimal sensor operation.
- .2 Circuit Control Hardware - (Power Packs)
- .1 Refer to electrical drawings.
  - .2 Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 13mm knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of two (4) sensors.

- .3 Control wiring between sensors and control units shall be Class II, 18-20 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.

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 datasheet.

3.2 Installation

- .1 Locate and install equipment in accordance with manufacturer's recommendations and as indicated.

3.3 Field Quality Control

- .1 Site Tests:
  - .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - for Electrical.
- .2 System Startup
  - .1 Manufacturer or the local agent shall include all necessary fees for system start-up, and onsite commissioning of the low voltage controls system to the satisfaction of the space occupants.
  - .2 Occupancy sensor(s) set time to 15minutes delay, adjust sensitivity to ensure HVAC system does not trigger detector.
- .3 Manufacturer or local agent shall confirm proper installation and operation of all system components. The start-up requirement is intended to verify:
  - .1 That all occupancy sensors are located, installed, and adjusted as intended by the factory and the contract documents.
  - .2 The occupancy sensors are operating within the manufacturers specifications.

- .3 The sensors and relay panels interact as a complete and operational system to meet the design intent.
- .4 Manufacturer or local agent to provide a written statement verifying that the system meets the above requirements.
- .4 Training:
  - .1 Manufacturer or local agent shall provide training to the departmental personnel in the operation, programming and maintenance of the lighting control system including all occupancy sensors and daylighting controls.
  - .2 Actuate control units in presence of Departmental Representative to demonstrate lighting circuits are controlled as designated.
- .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. 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.

### 3.4 Cleaning

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

END OF SECTION



PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .3 Section 26 05 00 - Common Work Results - Electrical.

1.2 References

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-C22.2 No.47-M90(R2001), Air-Cooled Transformers (Dry Type).
- .2 National Electrical Manufacturers Association (NEMA).

1.3 Product Data

- .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 all packaging materials at appropriate recycling facilities.
- .3 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management
- .4 Divert unused wiring materials from landfill to metal recycling facility as approved by Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 Transformers

- .1 Use transformers of one manufacturer throughout project and in accordance with CAN/CSA-C22.2No.47, CSA-C9.
- .2 Design 1.

- .1 Type: ANN.
- .2 Voltage taps: standard.
- .3 Basic Impulse Level (BIL): standard.
- .4 Hipot: standard.
- .5 Average sound level: standard.
- .6 Impedance at 17 degrees C: standard.
- .7 Enclosure: NEMA 1, removable metal front panel.
- .8 Mounting: floor.
- .9 Finish: in accordance with Section 26 05 00 - Common Work Results - Electrical.

## 2.2 Equipment Identification

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Label size: 7.

## PART 3 EXECUTION

### 3.1 Installation

- .1 Mount dry type transformers up to 75 kVA as indicated.
- .2 Ensure adequate clearance around transformer for ventilation.
- .3 Install transformers in level upright position.
- .4 Remove shipping supports only after transformer is installed and just before putting into service.
- .5 Loosen isolation pad bolts until no compression is visible.
- .6 Make primary and secondary connections in accordance with wiring diagram.
- .7 Energize transformers after installation is complete.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .3 Section 06 10 00 - Rough Carpentry - Short Form: Plywood Backboard.
- .4 Section 26 05 00 - Common Work Results - Electrical.
- .5 Section 26 28 21 - Moulded Case Circuit Breakers.

1.2 References

- .1 Canadian Standards Association (CSA International)
  - .1 CSA C22.2No.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.

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 plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

PART 2 PRODUCTS

2.1 Panelboards

- .1 Panelboards: to CSA C22.2No.29 and product of one manufacturer.
- .2 Install circuit breakers in panelboards before shipment.
- .3 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .4 250 and 600V panelboards: bus and breakers rated for interrupting capacity as indicated.
- .5 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.
- .6 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .7 Two keys for each panelboard and key panelboards alike.
- .8 Copper bus with neutral of same ampere rating as mains.
- .9 Mains: suitable for bolt-on breakers.
- .10 Trim with concealed front bolts and hinges.
- .11 Trim and door finish: baked grey enamel.
- .12 Where indicated on the electrical drawings, provide SPD protection at a common point for the electrical distribution system; SPD protection with equivalent ratings of 120kA/phase; Surge Withstand Capabilities of 12,000 based on ANSI/IEEE C3 Wave (10 kA).

2.2 Breakers

- .1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: 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 30A breakers installed as indicated. Turn over unused lock-on devices to Owner.
- .5 Lock-on devices for emergency lighting and exit sign circuits.

### 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.

## 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.
- .4 Connect neutral conductors to common neutral bus with respective neutral identified.
- .5 Wiring in panelboards shall extend beyond the respective breakers,

forming a 152 mm loop before returning to connect to the breaker terminals, so there will be flexibility for reconnecting within the panel. Wiring shall be secured with Ty-wraps or equivalent means to present a neat workmanlike appearance.

END OF SECTION

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PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .3 Section 26 05 00 - Common Work Results - Electrical.

1.2 References

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

1.3 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.
- .3 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

- .4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

PART 2 PRODUCTS

2.1 Switches

- .1 Specification grade 20A, 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:
- .3 Terminal holes approved for No. 10 AWG wire.
- .4 Silver alloy contacts.
- .5 Urea or melamine moulding for parts subject to carbon tracking.
- .6 Suitable for back and side wiring.
- .7 White toggle.
- .8 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .9 Switches of one manufacturer throughout project.

2.2 Receptacles

- .1 Specification grade duplex receptacles, CSA type 5-15 and 5-20 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 riveted grounding contacts.
- .2 Specification grade single receptacles CSA type 5-15 and 5-20R, 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.
  - .1 Other receptacles with ampacity and voltage as indicated.
  - .2 Receptacles of one manufacturer throughout project.
- .3 Specialty and exterior receptacles as indicated on the drawings and of the same family and quality as indicated above.

### 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 Stainless steel, vertically brushed, 1 mm thick cover plates, for wiring devices mounted in flush-mounted outlet box.
- .5 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .6 Weatherproof cast aluminum "while in use" cover for exterior receptacles.

## 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 - Electrical as indicated.

- .2 Receptacles:
  - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
  - .2 All receptacles, and their wall plates, shall be installed plumb, with long axis in the vertical position, U ground terminal on the top.
  - .3 Mount receptacles at height in accordance with Section 26 05 00 - Common Work Results - Electrical as indicated.
  - .4 Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .3 Cover plates:
  - .1 Protect stainless steel 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

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PART 1 GENERAL

1.1 Related Sections

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

1.2 References

- .1 Canadian Standards Association (CSA)
- .2 CSA C22.2No.248.12-[94] , Low Voltage Fuses Part 12: Class R (Bi-National Standard with, UL 248-12 (1st Edition).

1.3 Shop Drawings and Product Data

- .1 Submit shop drawings 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, and with the Waste Reduction Workplan.
- .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.
- .4 Ship fuses in original containers.
- .5 Store fuses in original containers.

PART 2 PRODUCTS

2.1 Fuses General

- .1 Fuses: product of one manufacturer for entire project.

- .2 Fuses for protection of motors, transformers, and electric heating circuits and feeders:
  - .1 Shall be HRC, Form I, Class J, Type D (Time Delay), plated contacts, rated 600V, current limiting type, standard time delay - hold 500% of current rating for 10 seconds.

PART 3 Execution

3.1 Installation

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure correct fuses fitted to physically matched mounting devices.
- .3 Ensure correct fuses fitted to assigned electrical circuit.
- .4 Fuse sizes shall be as indicated on the drawings. Six (6) spare fuses of each type and rating shall be provided.

END OF SECTION

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PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - 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(R2001), 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 Submittals

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit product data and shop drawings.
- .3 Submit test report for field testing of ground fault equipment to Departmental Representative and a certificate that system as installed meets criteria specified herein.

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.

- .3 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

## PART 2 PRODUCTS

### 2.1 Materials

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

### 2.2 Breaker Type Ground Fault Interrupter

- .1 Ground fault protection where required by circuit breakers in branch circuit panelboards shall be C.S.A. listed as Class "A" Group "1" with a sensitivity of 5 milliamps or greater. Breakers shall be of the thermal magnetic type incorporating a solid state ground fault sensing circuit and push to test push button. Breakers shall be of the bolt on design, and interchangeable with other panelboard breakers. Interrupting capacity shall be 10,000 amperes, R.M.S. symmetrical.

### 2.3 Ground Fault Protector Unit

- .1 Ground fault protection where required by receptacle devices, shall be C.S.A. listed as Class "A" Group "1" with a sensitivity of 5 milliamps or greater. Receptacle with built-in ground fault protection shall incorporate a solid state ground fault sensing circuit and

physically fit in a standard single gang outlet box, and be complete with a push to test, and reset push buttons. Devices shall not include thermal magnetic protection in addition to the ground fault protection.

PART 3 EXECUTION

3.1 Installation

- .1 Do not ground neutral on load side of ground fault relay.
- .2 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 00 - Common Work Results - Electrical and co-ordinate with Section 01 45 00 - Quality Control if required].

END OF SECTION

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PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.2 References

- .1 Canadian Standards Association (CSA International).
  - .1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE). CAN/CSA C22.2 No. 144

1.3 Submittals

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include time-current characteristic curves for breakers.

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.

- .3 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

## PART 2 PRODUCTS

### 2.1 Breakers General

- .1 Moulded-case circuit breakers and ground-fault circuit-interrupters: 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.
- .5 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .6 Circuit breakers with interchangeable trips as indicated.

### 2.2 Ground Fault Circuit-interrupter Breakers

- .1 Ground-fault circuit-interrupters (GFIC): to CSA C22.2 No. 144
- .2 Components comprising of ground fault protective system to be of same manufacturer
- .3 Single pole ground fault circuit interrupter amps/volts as indicated on drawings, circuit c/w test and reset facilities.

### 2.3 Thermal Magnetic Breakers

- .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 Circuit breakers shall be securely mounted in panelboards and tightened down to the bussing as per the manufacturer's recommended torque levels.
- .2 Install breakers in quantities as indicated.
- .3 Supply and install blank sections in panelboards for all unused breaker spaces.
- .4 Set trip units as required by the coordination study.
- .5 Arrange for field testing of ground fault circuit-interrupter breakers by contractor before commissioning service; demonstrate simulated ground fault tests.

END OF SECTION

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PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .3 Section 26 05 00 - Common Work Results - Electrical.
- .4 Section 26 28 14 - Fuses - Low Voltage.

1.2 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.

1.3 Submittals

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

1.4 Health and Safety

- .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.5 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 plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

## PART 2 PRODUCTS

### 2.1 Disconnect Switches

- .1 Fusible and non-fusible disconnect switches in CSA rated enclosures, size as indicated, Type "A".
- .2 Provision for padlocking in "ON" and "OFF" position.
- .3 Mechanically interlocked door to prevent opening when handle in "ON" position.
- .4 Fuses: size as indicated, in accordance with Section 26 28 14 - Fuses - Low Voltage.
- .5 Fuseholders: 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.
- .8 Fuseholder assemblies to CSA C22.2 No. 39.

### 2.2 Equipment Identification

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

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

PART 3 EXECUTION

3.1 Installation

- .1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

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PART 1 GENERAL

1.1 Related Sections

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

1.2 References

- .1 International Electrotechnical Commission (IEC)
  - .1 IEC 947-4-1-1990, Part 4: Contactors and motor-starters.

1.3 Shop Drawings and Product Data

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate:
  - .1 Mounting method and dimensions.
  - .2 Starter size and type.
  - .3 Layout of identified internal and front panel components.
  - .4 Enclosure types.
  - .5 Wiring diagram for each type of starter.
  - .6 Interconnection diagrams.

1.4 Closeout Submittals

- .1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Include operation and maintenance data for each type and style of starter.

1.5 Extra Materials

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide listed spare parts for each different size and type of starter:

- .1 [3] contacts, stationary.
- .2 [3] contacts, movable.
- .3 [1] contacts, auxiliary.
- .4 [1] control transformer[s].
- .5 [1] operating coil.
- .6 [2] fuses.
- .7 [10]% indicating lamp bulbs used.

1.6 Waste Management  
and Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal, and with the Waste Reduction Workplan.
- .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 Materials

- .1 Starters: to IEC 947-4 with AC4 utilization category.

2.2 Manual Motor Starters

- .1 Manual starters for single phase motors shall have toggle operating handle, quick make, quick break mechanism operating heavy sliding contacts. Overload devices of either eutectic alloy or bimetal construction shall be supplied and installed based on the motor name plate data. Starters for surface mounting shall be in general purpose NEMA I enclosures, those for flush mounting complete with stainless steel cover plates. Starters shall be complete with locking tabs. Starters shall be surface or flush mounted as indicated

on the drawings, or as dictated by the room finish schedule. Pilot lights shall be of the LED type and shall be included on all manual starters, unless specifically noted otherwise.

- .2 Manual starters shall be complete with an adjustable knob that allows a 10%, plus or minus, adjustment of the nominal thermal overload rating.

### 2.3 Full Voltage Magnetic Starters

- .1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
  - .1 Contactor solenoid operated, rapid action type.
  - .2 Motor overload protective device in each phase, manually reset from outside enclosure.
  - .3 Wiring and schematic diagram inside starter enclosure in visible location.
  - .4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
- .2 Combination type starters to include motor circuit interrupter with operating lever on outside of enclosure to control motor circuit interrupter, and provision for:
  - .1 Locking in "OFF" position with up to 3 padlocks.
  - .2 Independent locking of enclosure door.
  - .3 Provision for preventing switching to "ON" position while enclosure door open.
- .3 Accessories:
  - .1 Selector switches: standard labelled as indicated.
  - .2 Indicating lights: standard type and color as indicated.

- .3 2-N/O and 2-N/C spare auxiliary contacts unless otherwise indicated.

#### 2.4 Control Transformer

- .1 Single phase, dry type, control transformer with primary voltage as indicated and 120V secondary, complete with secondary fuse, installed in with starter as indicated.
- .2 Size control transformer for control circuit load plus 20% spare capacity.

#### 2.5 Finishes

- .1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results - Electrical.

#### 2.6 Equipment Identification

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.
- .3 Magnetic starter designation label, black plate, white letters, engraved as indicated.

### PART 3 Execution

#### 3.1 Installation

- .1 Install starters, connect power and control as indicated.
- .2 Ensure correct fuses and overload devices elements installed.

#### 3.2 Field Quality Control

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical and manufacturer's instructions.

- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END OF SECTION

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PART 1 GENERAL

1.1 Related Sections

- .1 Section 26 05 00 - Common Work Results.

1.2 References

- .1 Illuminating Engineering Society of North America (IESNA)
  - .1 IES-LM-79-08, Electrical and Photometric Measurements of Solid-State Lighting Products.
  - .2 IES-LM-80-15, Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules.
  - .3 IES-TM-21, Projecting Long Term Lumen Maintenance of LED Light Sources.
- .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 F1137-00(2006), 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)

### 1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 26 05 00 - Common Work Results.
- .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 the manufacturer's standard production model luminaire. The report shall include all photometric and electrical measurements, as well as all other pertinent data outlines under "14.0 Test Report" in IES-LM-79.
  - .3 LEDs shall be tested per IES-LM-79, IES-LM-80, and IES-TM-21 parameters.
- .3 Quality assurance submittals: provide following in accordance with Section 01 33 26 - Source Quality Control Reporting.
  - .1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, cleaning procedures and maintenance.

## PART 2 PRODUCTS

### 2.1 Drivers

- .1 Rated life: 50,000 hours (minimum) at Tcase of  $\leq 70^{\circ}$  C.
- .2 Flicker free dimming range.
- .3 Power factor 90% minimum.
- .4 Class "A" sound rating.
- .5 Thermally protected.

- .6 Dynamic end of life protection circuit.
- .7 Rated for 60 Hz and voltage as indicated by the circuit on the drawings.
- .8 0-10V dimming to 10%, standard.
- .9 LEDs of the same luminaire supplied from the same batch during manufacturing.

## 2.2 Finishes

- .1 Baked enamel finish:
  - .1 Conditioning of metal before painting:
    - .1 For corrosion resistance conversion coating to ASTM F1137.
    - .2 For paint base, conversion coating to ASTM F1137.
  - .2 Metal surfaces of luminaire housing and reflectors finished with high gloss baked enamel or polyester powdercoat to give smooth, uniform appearance, free from pinholes or defects.
  - .3 Reflector and other inside surfaces finished as follows:
    - .1 White, minimum reflection factor 85%.
    - .2 Colour fastness: yellowness factor not above 0.02 and after 250 hours exposure in Atlas fade-ometer not to exceed 0.05.
    - .3 Film thickness, not less than 0.03mm average and in no areas less than 0.025mm.
    - .4 Gloss not less than 80 units as measured with Gardner 60E gloss meter.
    - .5 Flexibility: withstand bending over 13mm mandrel without showing signs of cracking or flaking under 10 power magnification.
    - .6 Adhesion: 25mm square lattice made of 3mm squares cut through film to metal

with sharp razor blade.  
Adhesive cellulose tape  
applied over lattice and  
pulled. Adhesion  
satisfactory if no coating  
removed.

- .2 Alzak finish:
  - .1 Aluminium sheet fabricated from special aluminum alloys and chemically brightened, subsequently anodically treated:
    - .1 Finish for mild commercial service, minimum density of coating 7.8 g/m<sup>2</sup>, minimum reflectivity 83% for specular, 80.5% for semi-specular and 75% for diffuse.
    - .2 Finish for regular industrial service, minimum density of coating 14.8 g/m<sup>2</sup>, minimum reflectivity 82% for specular and 73% for diffuse.
    - .3 Finish for heavy duty service, minimum density of coating 21.8 g/m<sup>2</sup>, minimum reflectivity 85% for specular, 65% for diffuse.

### 2.3 Luminaires

- .1 As indicated in luminaire schedule.

## PART 3 EXECUTION

### 3.1 Installation

- .1 Supply, store and install all luminaires in such a manner that their attachment to the ceiling shall be secure in all respects. In order to avoid any danger that the weight of the fixtures might distort hung ceilings (where such occur), provide approved type independent supports to the satisfaction of the Departmental Representative.
- .2 Luminaires shall not be hung directly from plasterboard ceilings, but shall

derive their support from channels independently mounted in the ceiling space.

- .3 Provide any supporting angles, channels, unistrut, caddy clips, etc., required to adequately secure and support the luminaires. Exposed supporting system shall be painted white and blended in with the background colours.

### 3.2 Wiring

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

### 3.3 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.

### 3.4 Cleaning

- .1 Clean in accordance with Section 01 74 00 - Cleaning and Waste Management.
  - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

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PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .3 Section 26 05 21 - Wires and Cables (0-1000V).
- .4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 References

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

1.3 Submittals

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Data to indicate system components, mounting method, source of power and special attachments.

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 plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

- .4 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.
- .5 Dispose of unused batteries at official hazardous material collections site approved by Departmental Representative.
- .6 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 Equipment

- .1 Emergency lighting equipment: to CSA C22.2 No.141.
- .2 Supply voltage: 120 v or 347 V, ac.
- .3 Output voltage: 12V dc.
- .4 Operating time: 30 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, for 'AC Power ON' and 'High Charge'.
- .10 Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment. Lamp type: MR16 LED, 6W.
- .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: backed white enamel.
- .13 Auxiliary equipment:
  - .1 Test switch.
  - .2 Battery disconnect device.
  - .3 AC input and DC output terminal blocks inside cabinet.
  - .4 Bracket.
  - .5 Cord and plug connection for AC.
  - .6 Self diagnostic.

## 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: RW90 type in accordance with Section 26 05 21 - Wires and Cables 0-600V, sized as indicated in accordance with manufacturer's recommendations.

## PART 3 Execution

### 3.1 Installation

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

END OF SECTION



PART 1 GENERAL

1.1 References

- .1 Canadian Code for Preferred Packaging.
- .2 Canadian Standards Association (CSA):
  - .1 CSA C22.2 No.141-M1985(R1992), Unit Equipment for Emergency Lighting.
  - .2 CSA C860-11(R2016), Performance of Internally-Lighted Exit Signs.
- .3 National Fire Protection Association (NFPA) requirements.

1.2 Submittals

- .1 Submit product data in accordance with Section 01 33 00 - Submittals.
- .2 Submit product data sheets for exit lights. Include product characteristics, performance criteria, physical size, limitations and finish.
- .3 Manufacturer=s Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures.

1.3 Waste Management and Disposal

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal, and with Waste Reduction Workplan.
- .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.

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

## PART 2 PRODUCTS

### 2.1 Standard Units

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860, packaged in accordance with the Canadian Code for Preferred Packaging guidelines.
- .2 Housing: cold rolled steel minimum 1.0 mm thick, satin aluminum enamel finish cast anodized extruded aluminum housing, brush aluminum finish.
- .3 Face and back plates: extruded aluminum.
- .4 Lamps: 1.2W LED (max) indirect illumination unit, 120V TO 347 V input.
- .5 Operation: designed for hours of continuous operation without relamping.
- .6 Pictogram.

### 2.2 Design [X1]

- .1 Wall or ceiling mounting.
- .2 Single or Double face.
- .3 Arrow: as indicated.

## PART 3 EXECUTION

### 3.1 Installation

- .1 Install exit lights.

- .2 Connect fixtures to exit light circuits.
- .3 Ensure that exit light circuit breaker is locked in on position.

END OF SECTION

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