PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

.1 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.

.2 Reference Standards:
- .1 CSA Group
  - .1 CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.
  - .2 CSA C22.3 No. 1-10, Overhead Systems.
  - .3 CAN3-C235-83(R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
  - .1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit for review single line electrical diagrams under plexiglass and locate within each electrical room.

.3 Shop drawings:
- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
- .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
- .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .5 Submit required number of copies of drawings and product data to inspection authorities.
- .6 If changes are required, notify Departmental Representative of these changes before they are made.

.4 Certificates:
- .1 Provide CSA certified equipment and material.
- .2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.
- .3 Submit test results of installed electrical systems and instrumentation.
- .4 Permits and fees: in accordance with General Conditions of contract.
- .5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
- .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative .

1.3 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.5 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

- .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.
- .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.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

- .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect all materials from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 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 and French.

2.2 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 inspection authorities before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of Departmental Representative.

.2 Decal signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for copper.

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:
- .1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, black face, white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
- .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.

2.5 EQUIPMENT IDENTIFICATION (Cont'd)

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO." as directed by Departmental Representative.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages.

2.6 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.7 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.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Other	Green	Blue
Fire Alarm	Red	
Emergency	Red	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 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 overhead and underground systems in accordance with CAN/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 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: 1100 mm.
- .2 Wall receptacles:
  - .1 General: 400 mm.
  - .2 Above top of continuous baseboard heater: 200 mm.
  - .3 In mechanical rooms: 1200 mm.
- .3 Panelboards: as required by Code or as indicated.
- .4 Fire alarm stations: 1200 mm.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.7 FIELD QUALITY CONTROL

.1 Load Balance:
- .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
- .1 Power distribution system including phasing, voltage, grounding and load balancing.
- .2 Circuits originating from branch distribution panels.
- .3 Lighting and its control.
- .4 Systems: fire alarm.
- .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 Departmental Representative.

.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 - ACTION AND INFORMATIONAL 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.

3.8 SYSTEM STARTUP

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

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

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

1.2 DEFINITIONS

.1 Priority Two (P2) Buildings: buildings in which life safety is paramount concern. It is not necessary that P2 buildings remain operative during or after an earthquake.

.2 SRS: acronym for Seismic Restraint System.

1.3 GENERAL DESCRIPTION

.1 This section covers design, supply and installation of complete SRS for all systems, equipment specified for installation on this project. This includes electrical light fixtures, conduit, electrical equipment and systems, both vibration isolated and statically supported.

.2 SRS to be fully integrated into, compatible with:
- .1 Noise and vibration controls specified elsewhere in this project specification.
- .2 Structural, mechanical, electrical design of project.

.3 During seismic event, SRS to prevent systems and equipment from causing personal injury and from moving from normal position.

.4 Design to be by Professional Engineer specializing in design of SRS and registered in Province of Ontario. Division 26 to include all costs associated with this work as it relates to Division 26 installations. Submit design sketches c/w professional stamp prior to start of installations, c/w installation requirements.

1.4 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Submittals to include:
- .1 Full details of design criteria.

.3 Submit additional copy of shop drawings and product data to Structural Engineer for review of connection points to building structure.

1.5 MAINTENANCE DATA

.1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 26 05 00 - Common Work Results for Electrical.

PART 2 - PRODUCTS

2.1 SRS MANUFACTURER

.1 SRS to be from one manufacturer regularly engaged in production of same.

2.2 GENERAL

.1 SRS to provide gentle and steady cushioning action and avoid high impact loads

.2 SRS to restrain seismic forces in all directions.

.3 Fasteners and attachment points to resist same load as seismic restraints.

.4 SRS of conduit systems to be compatible with:
- .1 Expansion, anchoring and guiding requirements.
- .2 Equipment vibration isolation and equipment SRS.

.5 SRS utilizing cast iron, threaded pipe, other brittle materials not permitted.

.6 Attachments to RC structure:
- .1 Use high strength mechanical expansion anchors.
- .2 Drilled or power driven anchors not permitted.

.7 Seismic control measures not to interfere with integrity of firestopping.

2.3 SRS FOR STATIC EQUIPMENT, SYSTEMS

.1 Floor-mounted equipment, systems:
- .1 Anchor equipment to equipment supports.
- .2 Anchor equipment supports to structure.
- .3 Use size of bolts scheduled in approved shop drawings.

.2 Suspended equipment, systems:
- .1 Use one or combination of following methods:
  - .1 Install tight to structure.
  - .2 Cross-brace in all directions.
  - .3 Brace back to structure.
  - .4 Slack cable restraint system.
- .2 SRS to prevent sway in horizontal plane, "rocking" in vertical plane, sliding and buckling in axial direction.
- .3 Hanger rods to withstand compressive loading and buckling.

2.4 SRS FOR VIBRATION ISOLATED EQUIPMENT

.1 Floor mounted equipment, systems:
- .1 Use one or combination of following methods:
  - .1 Vibration isolators with built-in snubbers.
  - .2 Vibration isolators and separate snubbers.
  - .3 Built-up snubber system approved by Engineer, consisting of structural elements and elastomeric layer.
- .2 SRS to resist complete isolator unloading.
- .3 SRS not to jeopardize noise and vibration isolation systems. Provide 4-8 mm clearance between seismic restraint snubbers and equipment during normal operation of equipment and systems.
- .4 Cushioning action to be gentle and steady by utilizing elastomeric material or other means in order to avoid high impact loads.

2.4 SRS FOR VIBRATION ISOLATED EQUIPMENT (Cont'd)

.2 Suspended equipment, systems:
- .1 Use one or combination of following methods:
  - .1 Slack cable restraint system.
  - .2 Brace back to structure via vibration isolators and snubbers.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Attachment points and fasteners:
- .1 To withstand same maximum load that seismic restraint is to resist and in all directions.

.2 Install SRS at least 25 mm from all other equipment, systems, services.

.3 Miscellaneous equipment not vibration-isolated:
- .1 Bolt through house-keeping pad to structure.

.4 Co-ordinate connections with all disciplines.

3.2 INSPECTION AND CERTIFICATION

.1 SRS to be inspected and certified by Manufacturer upon completion of installation.

.2 Provide written report stamped by professional Engineer licensed in Ontario to Engineer with signed certificate of compliance with the SRS design requirements.

3.3 COMMISSIONING DOCUMENTATION

.1 Upon completion and acceptance of certification, hand over to Engineer complete set of construction documents, revised to show "as-built" conditions.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Canada Green Building Council (CaGBC)
- .1 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Commercial Interiors.

.2 CSA International
- .1 CAN/CSA-C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes and Fittings.
- .2 CAN/CSA-C22.2 No. 65-13, Wire Connectors (Tri-national standard, with UL 486A-486B and NMX-J-543- ANCE), Includes Update No. 1 (2013).

.3 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
- .1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.4 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
- .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Pressure type wire connectors to: CAN/CSA-C22.2 No. 65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CAN/CSA-C22.2 No. 65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2, NEMA 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 bar.
- .5 Bolts for aluminum conductors bar.
- .6 Sized for conductors tubes bars as indicated.

.4 Clamps or connectors for armoured cable, TECK cable flexible conduit, as required to: CAN/CSA-C22.2 No. 18.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

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

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

.2 Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

.3 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.4 Section 26 05 36 - Cable Trays for Electrical Systems.

1.2 PRODUCT DATA

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

1.3 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return of pallets, crates and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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 cross-linked thermosetting polyethylene material rated RW90 XLPE, Jacketted for 120/208V circuits. Use 1000V conductor for 600V circuits.

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Conductors:
- .1 Grounding conductor: copper.
- .2 Circuit conductors: copper, size as indicated.

.3 Insulation:
- .1 Cross-linked polyethylene XLPE.
- .2 Rating: 600 or 1000 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: flat interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride.

.7 Fastenings:
- .1 One hole zinc 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 at 1500 mm centers.
- .3 Threaded rods: 6 mm diameter to support suspended channels.

2.2 TECK 90 CABLE (Cont'd)

.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 galvanized steel strip.

.4 Connectors: anti short connectors.

2.4 CONTROL CABLES

.1 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated LVT: 4 soft annealed copper conductors, sized as indicated:
.1 Insulation: TW 40 degrees C.
.2 Shielding: tape coated with diamagnetic material wire metallized tapes over each conductor.
.3 Overall covering: polyethylene jackets.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

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

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

.3 Conductor length for parallel feeders to be identical.

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

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

.6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION BUILDING WIRES

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

3.4 INSTALLATION OF TECK 90 CABLE (0-1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable exposed, securely supported by straps.

3.5 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

3.6 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

END

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

.1 Institute of Electrical and Electronics Engineers (IEEE)
- .1 IEEE 837-2014, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

.2 CSA International
- .1 CSA Z32-09 (R2014), Electrical Safety and Essential Electrical Systems in Health Care Facilities.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
- .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect grounding equipment from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 EQUIPMENT

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

.2 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.3 Insulated grounding conductors: green, copper conductors, size as indicated.

.4 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
- .1 Grounding and bonding bushings.
- .2 Protective type clamps.
- .3 Bolted type conductor connectors.
- .4 Thermit welded type conductor connectors.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for grounding equipment installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied

3.2 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Use mechanical connectors for grounding connections to equipment provided with lugs.

.5 Soldered joints not permitted.

.6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.7 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.8 Connect building structural steel and metal siding to ground.

.9 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.2 INSTALLATION GENERAL (Cont'd)

.10 Bond single conductor, metallic armoured cables to cabinet at supply end, and load end.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, duct systems, distribution panels.

3.4 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room.

.2 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0AWG.

3.5 COMMUNICATION SYSTEMS

.1 Install grounding connections fire alarm, intercommunication systems as follows:
.1 Fire alarm, intercommunication systems as indicated.

3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END

PART 1 - GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect hangers and supports.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

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 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hangers and supports installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

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

3.2 INSTALLATION

.1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

3.2 INSTALLATION (Cont'd)

.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 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 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.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support 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.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS
.1 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES
.1 Canadian Standards Association (CSA International)
.1 CSA C22.1-12, Canadian Electrical Code, Part 1, 22nd Edition.

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

1.4 DELIVERY, STORAGE AND HANDLING
.1 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 SPLITTERS
.1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
.2 Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
.3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

2.2 JUNCTION AND PULL BOXES
.1 Construction:welded steel enclosure.
.2 Covers Flush Mounted: 25 mm minimum extension all around.
.3 Covers Surface Mounted: screw-on turned edge covers.

PART 3 - EXECUTION

3.1 SPLITTER INSTALLATION

.1 Mount plumb, true and square to building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

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

3.3 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 00 - Common Work Results for Electrical.

.2 Identification Labels: size 2 indicating voltage and phase or as indicated.

.3 Identify junction boxes with panel/circuit/voltage.

END

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. 56-13, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .4 CSA C22.2 No. 83-M1985(R2013), Electrical Metallic Tubing.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
- .1 Submit cable manufacturing data.

.3 Quality assurance submittals:
- .1 Test reports: submit certified test reports.
- .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

PART 2 - PRODUCTS

2.1 CABLES AND REELS

.1 Provide cables on reels or coils.
- .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

2.2 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel aluminum threaded.

.2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.3 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

.4 Minimum size conduit: 21 mm.

2.3 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller.
.1 Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1500 m on centre.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.
.1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

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

2.6 FISH CORD

.1 Polypropylene.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms.

.3 Surface mount conduits except as noted.

.4 Use electrical metallic tubing (EMT) except where specified otherwise.

.5 Use flexible metal conduit for connection to motors in dry areas.

.6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

3.2 INSTALLATION (Cont'd)

.7 Minimum conduit size for lighting and power circuits: 21 mm.

.8 Bend conduit cold:
.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.9 Mechanically bend steel conduit over 21 mm diameter.

.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.
.1 Do not use liquids to clean out conduits.

.13 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Group conduits wherever possible on suspended channels.

.3 Do not pass conduits through structural members except as indicated.

.4 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

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

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

.2 Section 26 28 16.02 - Moulded Case Circuit Breakers.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

.2 Include on drawings:

.1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect panelboards from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 BREAKERS

.1 Breakers: to Section 26 28 16.02 - 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 breakers installed as indicated. Turn over unused lock-on devices to Departmental Representative.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for 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, mounted in plastic envelope at inside of panel door.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.3 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by panelboards installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
- .1 CSA C22.2 No. 5-13, Molded-case circuit breakers, molded-case switches and circuit-breaker enclosures (Tri-national standard, with UL 489 and NMX-J-266-ANCE-2013), Update No. 1 (2014).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
- .1 Store circuit breakers in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect circuit breakers from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, Circuit breakers, and ground-fault circuit-interrupters, and: 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 Circuit breakers to have minimum 10,000 symmetrical rms interrupting capacity rating.

2.2 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 Install circuit breakers as indicated.

3.2 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.2 Underwriters' Laboratories of Canada (ULC)

.3 Illuminating Engineering Society of North America (IESNA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental Representative.

.3 Photometric data to include: spacing criterion.

.3 Complete Photometric Layout:

.1 Provide a fully complete plan with lighting levels indicated at work plane level using IESNA photometric files for all submitted light fixtures. Luminaire type and mounting height to be indicated. CAD Plans will be provided by Departmental Representative.

.4 Quality assurance submittals: provide following in accordance with Section01 45 00 - Quality Control.

.1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.3 QUALITY ASSURANCE

.1 Provide mock-ups (initial installation) in accordance with Section 01 45 00 - Quality Control.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse of pallets, crates, padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Divert unused metal materials from landfill to metal recycling facility.

.5 Disposal and recycling of fluorescent lamps as per local regulations.

.6 Disposal of old PCB filled ballasts as per local regulations.

PART 2 - PRODUCTS

2.1 FIXTURE TYPES .1 Refer to drawing for Lighting Schedule.

2.2 LAMPS .1 Fluorescent lamps to be - T5HO, 49 Watt, medium bi-pin, rapid-start, 3500 K, 30,000 hour lamp life, 5000 initial lumens, CRI 80; or as indicated.

.2 Compact fluorescent lamps to be - 18 Watt, G24q-2 base, 12,000 hour lamp life, 12,000 initial lumens, 3500 K, CRI 80; or as indicated.

2.3 BALLASTS .1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic IC electronic dimmable.

.1 Rating: voltage as indicated, for use with 2-54W, rapid start lamps.
.2 Totally encased and designed for 40 degrees Celsius ambient temperature.
.3 Power factor: minimum 95% with 95% of rated lamp lumens.
.4 Current crest factor: 1.7 maximum.
.5 Harmonics: 10 % maximum THD.
.6 Operating frequency of electronic ballast: 20 kHz minimum.
.7 Total circuit power: 62 Watts.
.8 Ballast factor: greater than 0.90.
.9 Sound rated: Class A.
.10 Mounting: integral with luminaire.

2.4 LED LIGHT SOURCES .1 Solid state lighting devices c/w integrated optical assemblies.

.2 Minimum 70 CRI. Minimum 90% LLF @ 50,000 hrs. power factor 90%. THD > 20%.

.3 3500 K colour temperature.

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

2.6 OPTICAL CONTROL DEVICES .1 As indicated in Appendix - Luminaire Description.

2.7 LUMINAIRES .1 As indicated in Appendix - Luminaire Description.

PART 3 - EXECUTION

3.1 DEMOLITION

.1 Dispose of old PCB filled ballasts as per local regulations.

.2 Recycle lamps and ballasts removed from demolition as per local regulations.

3.2 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Provide adequate support to suit ceiling system.

3.3 WIRING

.1 Connect luminaires to lighting circuits.
.1 Install flexible or rigid conduit for luminiaries as idnicated.

3.4 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires independently of ceiling.

3.5 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 or as indicated.

3.6 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.
.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

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

END

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCES

.1 Canada Green Building Council (CaGBC)
- .1 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.

.2 Treasury Board of Canada Secretariat (TBS), Occupational Safety and Health (OSH)
- .1 Fire Protection Standard-10.

.3 Underwriter's Laboratories of Canada (ULC)
- .1 CAN/ULC-S524-06, Standard for the Installation of Fire Alarm Systems.
- .2 CAN/ULC-S525-07, Audible Signal Devices for Fire Alarm Systems, Including Accessories.
- .3 CAN/ULC-S536-13, Inspection and Testing of Fire Alarm Systems.
- .4 CAN/ULC-S537-13, Verification of Fire Alarm Systems.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for multiplex fire alarm devices and voice communication speakers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
- .1 Indicate on shop drawings:
  - .1 Details for devices.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for fire alarm and voice communication systems for incorporation into manual.

.3 Include:
- .1 Instructions for complete fire alarm system to permit effective operation and maintenance.
- .2 Technical data - illustrated parts lists with parts catalogue numbers.
- .3 Copy of approved shop drawings with corrections completed and marks removed except review stamps.
- .4 List of recommended spare parts for system.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Extra Stock Materials: submit 2 spare glass rods for manual pull box stations if applicable.

1.6 QUALITY ASSURANCE

.1 Inspection tests to conform to: CAN/ULC-S536.

.2 Submit inspection report, to Departmental Representative.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
- .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect materials from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 EXISTING SYSTEM

.1 The existing system consists of a Siemens, model MXLV, 2 stage fire/voice communications system. All materials must be selected to ensure, compatibility with existing fire alarm system. Carry Siemens for all programming and verifications.

2.2 WIRING

.1 FAS cables, copper conductors.

.2 To initiating circuits: 18 AWG minimum, and in accordance with manufacturer's requirements.

.3 To signal circuits: 16 AWG minimum, and in accordance with manufacturer's requirements.

.4 To speaker circuits: twisted, shielded pairs, and in accordance with manufacturer's requirements.

.5 To telephone circuits: twisted, shielded pairs, and in accordance with manufacturer's requirements.

.6 To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.

2.2 WIRING (Cont'd)

.7 Risers: twisted, shielded pairs, 1 h fire-rated configured to eliminate interference and cross-talk.

2.3 MANUAL ALARM STATIONS

.1 Manual alarm stations: pull lever, wall mounted semi-flush type, non-coded single pole normally open contact for single stage and general alarm key switch for two stage system bilingual English French signage.

.2 Addressable manual pull station:

.1 Pull lever, break glass rod, semi-flush wall mounted type, single action, single 2 stage, electronics to communicate station's status to addressable module/transponder over 2 wires and to supply power to station. Station address to be set on station in field.

2.4 AUTOMATIC ALARM INITIATING DEVICES

.1 Heat detectors, fixed temperature, non- restorable, rated 57 & 88 degrees C.

.2 Addressable smoke detector:

.1 Ionization type.
.2 Electronics to communicate detector's status to addressable module/transponder.
.3 Detector address to be set on detector base in field.

2.5 AUDIBLE SIGNAL DEVICES

.1 Speakers:

.1 Cone type: recessed round ceiling mounted within T-bar ceiling or drywall and as per building standard.

2.6 VISUAL ALARM SIGNAL DEVICES

.1 Strobe type: flashing, red, 24 V.

.2 Recessed in ceiling as shown.

2.7 END-OF-LINE DEVICES

.1 End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install systems to CAN/ULC-S524 and TBS OSH Fire Protection Standard.

.2 Locate and install detectors and connect to alarm circuit wiring. Mount detectors more than 1 m from air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.

.3 Connect alarm circuits to main control panel.

.4 Install signal to CAN/ULC-S525 and connect to signalling circuits.

.5 Connect signalling circuits to main control panel.

.6 Install end-of-line devices at end of alarm and signalling circuits.

.7 Install door releasing devices.

.8 Install remote relay units to control fan shut down.

.9 Sprinkler system: wire alarm and supervisory switches and connect to control panel.

.10 Room detection system.
- .1 Install detectors. Make necessary connections between room detection panel and main fire alarm panel.
- .2 Locate and install audible signals.

.11 Splices are not permitted.

.12 Provide necessary raceways, cable and wiring to make interconnections to terminal boxes, annunciator equipment and CCU, as required by equipment manufacturer.

.13 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.

.14 Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.

.15 Install speakers and connect to speaker circuits.

.16 Contractor shall be responsible and pay for any system bypass during construction.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and to CAN/ULC-S537.

.2 Fire alarm system:
- .1 Test device and alarm circuit to ensure manual stations, thermal and smoke detectors transmit alarm to control panel and actuate first stage alarm.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 MAINTENANCE

.1 Provide one year's free maintenance with two inspections by manufacturer during warranty period.

END