
Part 1 General

1.1 GENERAL SUMMARY

- .1 General requirements that are common to Sections of Division 26 – Electrical.

1.2 RELATED SECTIONS:

- .1 Division 01 – General Requirements.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International) Latest Edition of the following:
 - .1 CSA C22.1-06, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.
 - .2 CAN3-C235-83 (R2003) Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC) Latest Edition of the following:
 - .1 EEMAC 2Y-1, Light Gray Colour for Indoor Switch Gear.
- .3 Health Canada / Workplace Hazardous Materials Information System (WHMIS) Latest Edition of the following:
 - .1 Material Safety Data Sheets (MSDS).
- .4 CAN/CSA-Z460-05 Control of Hazardous Energy – Lockout and Other Methods.

1.4 SUMMARY OF WORK

- .1 The work shall include all labour, materials and equipment necessary for the complete installation of the electrical, communications and electronic safety and security systems shown on the drawings and described in these specifications.
- .2 It is the requirement of this work to provide all systems completely functioning in intended system operation, notwithstanding that every item necessarily required may not be specifically mentioned.

1.5 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 and French.

1.6 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS to General Contractor in accordance with Division 01- General Requirements for inclusion in onsite manual.
- .3 Shop drawings:
 - .1 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
 - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
 - .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
 - .4 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.
 - .5 Submit required number of copies of drawings and specifications to authority having jurisdiction and to inspection authorities.
 - .1 If changes are required, notify Departmental Representative of these changes.
 - .6 In addition to transmittal letter referred to in Division 01 – General Requirements: **Identify section and paragraph number.**

1.7 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into operation and maintenance manual specified in Division 01 – General Requirements. See Appendix A for Operation and Maintenance Manual Guidelines. Include Warranty Letter.
- .2 Include in Operation and Maintenance Data:
 - .1 Details of design elements and construction requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
 - .2 Technical data, product data, supplemented by bulletins, component illustrations, exploded view, technical descriptions of items and parts lists. Advertising or seals literature not acceptable.
 - .3 Wiring and schematic diagrams and performance curves.
 - .4 Names, addresses and telephone numbers of local suppliers for items included in maintenance manuals.
 - .5 Copy of reviewed shop drawings.

1.8 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with Division 01 – General Requirements and as indicated in respective specification sections.

1.9 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Division 01 – General Requirements.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 – General Requirements.

1.10 CLEARANCES

- .1 Provide space for disassembly, removal of equipment and components as recommended by Manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment or components.

1.11 TRIAL USAGE

- .1 General
 - .1 Commissioning requirements in accordance with Division 01 – General Requirements.
 - .2 Departmental Representative and Commissioning Agent may use equipment and systems for test purposes prior to acceptance. Supply labour, material and instruments required for testing.

1.12 TESTS

- .1 Give 48 hours written notice of date for all tests.
- .2 Conceal work only after testing and approval by Departmental Representative and after AHJ has inspected work.
- .3 Conduct tests in presence of Departmental Representative and local authority having jurisdiction where applicable.
- .4 Bear costs including retesting and making good.
- .5 Equipment: test as specified in relevant sections.
- .6 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

1.13 INTERPRETATION OF PLANS AND SPECIFICATIONS

- .1 These specifications are to be considered as an integral part of the plans which accompany them and neither the plans nor the specifications shall be used alone. Any item which is omitted in one but which is reasonably implied in the other shall be considered properly and sufficiently specified and must, therefore, be provided by this Contractor.
- .2 Misinterpretation of the plans or specifications shall not relieve this Contractor of responsibility; final interpretation of details and clauses remains with the Departmental Representative.

- .3 Where uncertainty exists in the passing of conduits and location of equipment, the General Contractor and or project manager shall be consulted before work is started. Where such materials and equipment have been installed so as to cause interference with the inside treatment of the building, they shall be removed and relocated without additional cost to the Owner.

- .4 Drawings are diagrammatic. Building dimensions shall not be scaled from the Electrical plans but shall be obtained from on-site dimensions of the building.

Any discrepancy between the drawings and the building shall be questioned before proceeding with any installation.

1.14 CO-OPERATION OF CONTRACTORS

- .1 This Contractor shall become familiar with the work of other contractors and in laying out and installing the work shall co-operate with the other Contractors, so as to facilitate the progress of the work as a whole and avoid interference or delays. Where interference exists, this Contractor shall notify the General Contractor and/or project manager and the Departmental Representative before installing the work. Any changes in the work or alterations of the Electrical Contractor's schedule required for such co-operation will not be considered as a claim for extra compensation.
- .2 Due to the complexities of many sub-trades, and the restrictive space available in this project, it is required that all trades co-operate closely so as to install all systems in their allotted locations as indicated on the drawings, or coordination on site.

1.15 ERRORS AND OMISSIONS

- .1 The drawings are not intended to show every item of accessory equipment, but the Contractor shall tender on and install all essential details to provide for efficiency of operation and ease of maintenance.
- .2 Should this Contractor discover errors or discrepancies in the plans or specification, he shall refer the matter to the Departmental Representative for change or clarification and shall not proceed with that portion of the work until advised by the Departmental Representative to do so.

1.16 DELIVERY, STORAGE, AND HANDLING

- .1 Waste Management and Disposal:
- .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.
- .2 Store and handle materials in accordance with Construction Plan and Manufacturer's written instructions.

1.17 SYSTEM STARTUP

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

1.18 PERMITS, FEES AND INSPECTION

- .1 Submit to Electrical Inspection Department necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Obtain an electrical work permit and pay associated fees.
- .3 Contractor will provide drawings, specifications required by Provincial Electrical Inspection Department and Supply Authority at no cost.
- .4 Notify Departmental Representative of changes required by the Provincial Inspection Department prior to making changes.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with Division 01- General Requirements.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction, before delivery to site.
- .3 Factory assemble electrical panels and component assemblies.
- .4 Do verification requirements in accordance with Division 01 – General Requirements.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Division 26 responsibility is as follows:
 - .1 Supply and installation of breakers and/or switches.
 - .2 Supply and installation of power feeder (conduit and wire) from panel to starter, from starter to disconnect switch and from disconnect switch to motor.
 - .3 Supply and installation of starters complete with motor protection unless noted otherwise.
 - .4 Supply and installation of disconnect switches at motors unless noted otherwise.
 - .5 Supply and installation of 120V power feeders to mechanical equipment as indicated on drawings.
- .3 Control wiring and conduit is by Division 25 unless noted otherwise on electrical drawings.

2.3 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of authority having jurisdiction, inspection authorities and Departmental Representative.
- .2 Signs, minimum size 178 x 254 mm.

2.4 WIRING TERMINATIONS

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

2.5 EQUIPMENT IDENTIFICATION

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

NAMEPLATE SIZES

| | | | |
|--------|-------------|---------|--------------------|
| Size 1 | 11 x 51 mm | 1 line | 3 mm high letters |
| Size 2 | 13 x 73 mm | 1 line | 5 mm high letters |
| Size 3 | 13 x 22 mm | 2 lines | 3 mm high letters |
| Size 4 | 13 x 160 mm | 1 line | 10 mm high letters |
| Size 5 | 13 x 89 mm | 2 lines | 5 mm high letters |
| Size 6 | 25 x 102 mm | 1 line | 13 mm high letters |
| Size 7 | 25 x 102 mm | 2 lines | 13 mm high letters |

- .3 Wordings on nameplates to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate.
- .5 Identification to be English and French.
- .6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage. Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Switch board and panels: indicated amperage, voltage and interrupting rating.
- .9 Transformers: indicate capacity, primary and secondary voltages.

2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or 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 – 2006.
- .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 13 mm wide auxiliary colour.

| | Primary | Auxiliary |
|---------------------------------|----------------|------------------|
| up to 250 V | Yellow | |
| up to 600 V | Yellow | Green |
| Telephone | Green | |
| Other Communication Systems | Green | Blue |
| Fire Alarm | Red | |
| Security Systems | Red | Yellow |
| Public Address | Blue | |
| Data | Blue | White |
| Emergency Lighting & Exit Signs | (ac) Orange | White |
| Emergency Lighting & Exit Signs | (dc) Brown | White |

2.8 HOUSE KEEPING PADS

- .1 Co-ordinate with the General Contractor for the provision of Housekeeping Pads under floor mounted equipment.
- .2 Provide concrete housekeeping pads for all switchboards, transformers and all other free-standing electrical equipment. Pads to be a minimum of 153 mm larger than the outside dimensions of the equipment they support, and not less than 102 mm thick.

Part 3 Execution

3.1 INSTALLATION

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

3.2 NAMEPLATES AND LABELS

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

3.3 CONDUIT AND CABLE INSTALLATION

- .1 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 51 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings to be embedded or plastered over, neatly and 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 102 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3 m, and information is given before installation.

3.5 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1200 mm.
 - .2 Wall receptacles:
 - .1 General: 400 mm.
 - .2 Above top of continuous baseboard heater: 200 mm.
 - .3 Above top of counters or counter splash backs: 150 mm.
 - .4 In mechanical rooms: 1200 mm.
 - .3 Panel boards: as required by Code or as indicated.
 - .4 Voice and data outlets: 400 mm.
 - .5 Wall mounted telephone and interphone outlets: 1200 mm.
 - .6 Fire alarm stations: 1350 mm.
 - .7 Wall mounted fire alarm horn/strobes: 150 mm below ceiling or 2300 mm.
 - .8 Door bell pushbuttons: 1200 mm.

3.6 FIELD QUALITY CONTROL

- .1 Conduct and pay for following tests in accordance with Division 01 – General Requirements.
 - .1 Circuits originating from branch distribution panels.
 - .2 Lighting and its control.
 - .3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .4 Systems: fire alarm system, communications, security, Intercom/PA and emergency lighting.
 - .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.
 - .4 Replace conductors as required.

- .2 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .3 Manufacturer's Field Services:
 - .1 Obtain written certificates from manufacturers verifying compliance of Work, in handling, installing, applying, protecting and cleaning of products and with operation and maintenance manuals.
 - .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.

3.7 AS-BUILT DRAWINGS BY CONTRACTOR

- .1 General: To be read in conjunction with Division 01 – General Requirements.
- .2 Site Records:
 - .1 Obtain sets of white prints and mark thereon all changes as work progresses and as changes occur. Incorporate all information issued in Addenda, Site Instructions, Change Orders and all changes in actual installation as a result of site conditions and coordination.
- .3 As-Built Drawings:
 - .1 Prior to start of testing, balancing and adjusting, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 13 mm high as follows: AS-BUILT DRAWINGS (This drawing has been revised to show electrical systems as installed) (Signature of Contractor) (Date)
 - .3 Submit to the General Contractor for approval and make all corrections as directed.
 - .4 Testing, balancing and adjusting to be performed using as-built drawings.

3.8 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 00 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

3.9 DEMONSTRATION

- .1 Departmental Representative and Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 Departmental Representative may record these demonstrations on video tape for future reference.

3.10 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

3.11 CONTROL OF HAZARDOUS ENERGY

- .1 Lock out and tag out all electrical and other equipment before performing work as per CAN/CSA Z460-05.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA C22.2 No .0.3-01 (R2005), Test Methods for Electrical Wires and Cables Latest Edition.
- .2 CAN/CSA-C22.2 No. 131-M89 (R2004), Type TECK 90 Cable Latest Edition.

1.2 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 – General Requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 26 05 00 - Common Work Results Electrical.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.

Part 2 Products

2.1 BUILDING WIRES

- .1 Conductors: stranded for #8 AWG copper and larger. Minimum size: 12 AWG.
- .2 Conductors: size as indicated, with 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.
- .3 Neutral conductor insulated for 600V shall be continuous with no fuses, switches, or breaks of any kind.
- .4 Wiring for specialized systems such as fire alarm and public address, etc. shall be indicated in other sections or on drawings.
- .5 The voltage drop in no case shall exceed 3% of the line volts for 15A, 120V branch circuits.

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 Type: ethylene propylene rubber.
 - .2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking.
- .6 Overall covering: thermoplastic polyvinyl chloride material.
- .7 Fastenings:
 - .1 Channel type supports for two or more cables at 1.5 m centers.
 - .2 Threaded rods: 13 mm dia. to support suspended channels.
- .8 Connectors:
 - .1 Watertight, approved for TECK cable.

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 OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34
 - .2 In underground ducts and trenches in accordance with Section 26 05 43.
 - .3 Use vibration proof expanding spring wire connectors for No. 10 and smaller.

3.3 INSTALLATION OF TECK CABLE 0 -1000 V

- .1 Install cables.
 - .1 Group cables wherever possible on channels.
- .2 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - 0 - 1000 V.

3.4 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Division 01 – General Requirements.

3.5 CLEANING

- .1 Proceed in accordance with Division 01 – General Requirements.
- .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 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association, CSA C22.1 – 2006, Canadian Electrical Code, Part 1.

1.3 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 – General Requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 26 05 00 - Common Work Results Electrical.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.

Part 2 Products

2.1 EQUIPMENT

- .1 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .2 Insulated grounding conductors: green, type RW90.
- .3 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 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 GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.
- .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 ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install separate ground conductor to outdoor lighting standards.
- .9 Connect building structural steel and metal siding to ground by welding copper to steel.
- .10 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .11 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at 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, frames of motors, starters, control panels, building steel work, elevators, distribution panels, outdoor lighting.

3.4 FIELD QUALITY CONTROL

- .1 Verifications requirements in accordance with Division 01 – General Requirements.
- .2 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

3.5 CLEANING

- .1 Proceed in accordance with Division 01 – General Requirements.
- .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 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.2 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 – General Requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 26 05 00 - Common Work Results Electrical.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Comply with requirements of Section 01 and Section 26 05 00 – Common Work Results – Electrical.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Division 01 – General Requirements and Section 26 05 00 – Common Work Results Electrical.

2.2 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 x 2.5 mm thick, surface mounted or suspended.

2.3 VOC LIMITS

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

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 Secure equipment to hollow or solid masonry, tile and plaster surfaces with nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 51 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 51 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .7 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 10 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .14 Powder actuated fasteners are not acceptable.

3.3 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Division 01 – General Requirements.

3.4 CLEANING

- .1 Proceed in accordance with Division 01 – General Requirements.
- .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 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.2 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 – General Requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 26 05 00 - Common Work Results Electrical.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Division 01 – General Requirements and Section 26 05 00 – Common Work Results Electrical.

2.2 JUNCTION AND PULL BOXES

- .1 Welded steel construction with gasketed screw-on flat covers for surface mounting.
- .2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 VOC LIMITS

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

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 JUNCTION AND PULL BOXES INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Install pull boxes so as not to exceed 30 m of conduit run or 2-90° bends between pull boxes.

3.3 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.

3.4 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Division 01 – General Requirements.

3.5 CLEANING

- .1 Proceed in accordance with Division 01 – General Requirements.
- .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 Division 01- General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.2 REFERENCES

- .1 CSA C22.1-2006, Canadian Electrical Code, Part 1.

1.3 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 – General Requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 26 05 00 - Common Work Results Electrical.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Division 01 – General Requirements and Section 26 05 00 – Common Work Results Electrical.

2.2 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1 - 2006.
- .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 Combination boxes with barriers where outlets for more than one system are grouped.

2.3 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 51 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 walls.

2.4 MASONRY BOXES

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

2.5 CONCRETE BOXES

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

2.6 CONDUIT BOXES

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

2.7 FITTINGS FOR FLEXIBLE CONDUIT

- .1 Threaded type steel couplings and fittings.
- .2 Bushing and connectors with nylon insulated throats.
- .3 Knock-out fillers to prevent any debris.
- .4 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
- .5 Double locknuts and insulated bushings on sheet metal boxes.
- .6 Compression nut, grounding ferrule, sealing ring and body shop.

2.8 FITTINGS FOR THIN WALL CONDUIT

- .1 Steel set screw type connectors and couplings.
- .2 Double locknuts and insulated bushings on sheet metal boxes.

2.9 FITTINGS IN WET OR DAMP LOCATIONS

- .1 Watertight fittings on conduit in wet or damp locations.

2.10 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.

2.11 VOC LIMITS

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

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 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, and armoured cable connections. Reducing washers are not allowed.

3.3 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Division 01 – General Requirements.

3.4 CLEANING

- .1 Proceed in accordance with Division 01 – General Requirements.
- .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 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA) Latest Edition of the following:
 - .1 CAN/CSA C22.2 No. 18.3-04 Conduit, Tubing and Cable Fittings.
 - .2 CSA C22.2 No. 56-04 Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .3 CSA C22.2 No. 83-M 1985 (R2003), Electrical Metallic Tubing.
 - .4 CSA C22.2 No. 211.2-M 1984 (R2003), Rigid PVC (Unplasticized) Conduit.

1.3 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 – General Requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 26 05 00 - Common Work Results Electrical.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Division 01 – General Requirements.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Division 01 – General Requirements and Section 26 05 00 – Common Work Results Electrical.

2.2 CONDUITS

- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83 – M 1985 (R003), with couplings.
- .2 Flexible metal conduit: to CSA C22.2 No. 56-04, steel and liquid-tight flexible metal.
- .3 Rigid PVC conduit: to CSA C22.2 No. 211.2.

2.3 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 51 mm and smaller. Two hole steel straps for conduits larger than 51 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m oc.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

- .1 Rain tight EMT connectors shall be used on "vertical" sections of conduit runs where terminating into tops of electrical equipment incorporating drip shields or hoods.
- .2 Fittings: Use set screw connectors and fittings for EMT. Coating: same as conduit.
- .3 Factory "ells" where 90 degree bends are required for 25 mm and larger conduits.
- .4 Connectors for flexible conduit, shall be set screw galvanized steel.
- .5 Connectors for liquid tight flexible conduit shall be water tight, compression type galvanized steel.
- .6 Threaded plastic or metal bushings to be installed on all EMT connectors sizes 35 mm and larger.
- .7 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

2.5 FISH CORD

- .1 Polypropylene.

2.6 VOC LIMITS

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

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 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

- .3 EMT shall be installed as a complete system.
- .4 Support of electrical systems raceway shall be independent of any type of suspended ceiling support rods, wires, etc. and mechanical piping or duct systems.
- .5 Use electrical metal tubing (EMT) for all work, unless otherwise indicated, for panelboard feeders, branch circuit wiring, fire alarm and communications, etc., where not installed underground unless specifically indicated otherwise. Provide a separate green ground for all conduit systems, including E.M.T.
- .6 Flexible Metal Conduit:
 - .1 Use flexible metal conduit for connection to surface or recessed fluorescent fixtures.
 - .2 Flexible metal conduit, permitted above T-bar ceilings, for drops to various fire alarm devices mounted on flush outlet boxes in finished ceiling. Minimum size of flexible conduit: 22 mm, Maximum length of drop: 1.5 m.
- .7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment, furniture and transformers. Include a separate ground wire.
- .8 Use rigid PVC conduit for long outside lengths.
- .9 Install conduit sealing fittings in hazardous areas. Fill with compound.
- .10 Minimum conduit size for lighting and power circuits: 16 mm.
- .11 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .12 Mechanically bend steel conduit over 22 mm dia.
- .13 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .14 Install fish cord in empty conduits.
- .15 Run 2 – 25 mm spare conduits up to ceiling space for each flush panel. Terminate these conduits in 153 x 153 x 102 mm junction boxes in ceiling space.
- .16 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .17 Dry conduits out before installing wire.
- .18 Securely fasten in place within 83 mm of each outlet box, junction box, cabinet, coupling or fitting, maximum spacing between supports as follows:
 - 1.5 m for 21 mm trade size conduit and smaller.
 - 2 m for 27 mm to 35 mm trade size conduit.
 - 3 m for 41 mm trade size and larger.
- .19 Ground Wires: Provide a separate green ground wire in all conduit including EMT.

3.3 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 76 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 Division 01 – General Requirements.
- .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 GENERAL SUMMARY

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

1.2 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.
- .3 Section 26 28 21 - Moulded Case Circuit Breakers.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International) Latest Edition of the following:
 - .1 CSA C22.2 No.29–M 1989 (R2004), Panelboards and Enclosed Panelboards.

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed shop drawings, product literature, specifications and datasheets in accordance with Division 01 – General Requirements. Include product characteristics, performance criteria, and limitations.
 - .1 Shop Drawings shall include electrical detail of panel, branch breaker types and quantities ampacity voltage and enclosure dimensions.
- .2 Quality assurance submittals: submit in accordance with Division 01 – General Requirements.

1.5 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 – General Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 26 05 00 - Common Work Results Electrical.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Division 01 – General Requirements and Section 26 05 00 – Common Work Results Electrical.

2.2 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No.29–M 1989 (R2004) and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
 - .3 All Panels shall be fully bussed and breaker ready.
- .2 250V panelboards: bus and breakers rated for 10 kA (symmetrical) interrupting capacity minimum.
- .3 600V panelboards: bus and breakers rated for 18KA (symmetrical) interrupting capacity minimum.
- .4 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.
- .5 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .6 Two keys for each panelboard and key panelboards alike.
- .7 Copper bus with neutral of same ampere rating as mains.
- .8 Mains: suitable for bolt-on breakers.
- .9 Trim with concealed front bolts and hinges.
- .10 Trim and door finish: baked grey enamel.

2.3 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 bottom of panel to suit cable entry.

2.4 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. Secure with double faced type.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

2.5 APPROVED MANUFACTURERS:

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

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 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.

3.3 TESTS

- .1 Test each branch breaker to verify that it controls the load indicated on the drawing and panel directory.

3.4 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Division 01 – General Requirements.

3.5 CLEANING

- .1 Proceed in accordance with Division 01 – General Requirements.
- .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 GENERAL SUMMARY

- .1 Materials for moulded-case circuit breakers.

1.2 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.
- .3 Section 26 24 17 – Panelboards Breaker Type.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International) Latest Edition of the following:
 - .1 CSA-C22.2 No. 5-2 (R2007), Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMJ-J-266-ANCE).

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed shop drawings, product literature, specifications and datasheets in accordance with Division 01 – General Requirements. Include product characteristics, performance criteria, and limitations.
 - .1 Include time-current characteristic curves for breakers with ampacity of 100A and over.
 - .2 Quality assurance submittals: submit in accordance with Division 01 – General Requirements.

1.5 QUALITY ASSURANCE

- .1 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 – General Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 26 05 00 - Common Work Results Electrical.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Division 01 – General Requirements and Section 26 05 00 – Common Work Results Electrical.

2.2 BREAKERS GENERAL

- .1 Moulded-case circuit breakers: 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°C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .5 Match interrupting rating for breakers added to existing panelboards.

2.3 ACCEPTABLE MATERIALS

- .1 Breakers shall be compatible with panelboards specified in Section 26 24 17 – Panelboards Breaker Type and shall meet the KA ratings as indicated.

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 Install circuit breakers as indicated.

3.3 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Division 01 – General Requirements.

3.4 CLEANING

- .1 Proceed in accordance with Division 01 – General Requirements.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.5 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Division 01 – General Requirements.

3.6 CLEANING

- .1 Proceed in accordance with Division 01 – General Requirements.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION