
Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements that are common to Sections of Division 26 – Electrical, Division 27 – Communications and Division 28 – Electronic Safety and Security.

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 C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.
 - .2 CAN3-C235-83 (R2003) Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 CAN/CSA-Z460-05 Control of Hazardous Energy – Lockout and Other Methods

1.4 SCOPE 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 Division 01 – General Requirements.
- .2 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 Engineer of these changes.
- .6 In addition to transmittal letter referred in Division 01 – General Requirements:
Identify section and paragraph number on each shop drawing.

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.
- .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.

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 systems, equipment or components.

1.11 TRIAL USAGE

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

1.12 FIRESTOPPING

- .1 All fire stopping work is to be performed by General Contractor.
- .2 Electrical contractor shall coordinate all fire rated assembly penetrations with General Contractor.
- .3 Electrical Contractor shall provide required clearances between outside surface of conduit and inside surface of sleeve, core drilled hole or listed fire rated system.

1.13 TESTS

- .1 Give 48 hours written notice of date for all tests.
- .2 Conceal work only after testing and approval by Engineer and after Authority Having Jurisdiction has inspected work.
- .3 Conduct tests in presence of Engineer 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.

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

1.15 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 engineer 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 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 as coordination on site.

1.16 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 Engineer for change or clarification and shall not proceed with that portion of the work until advised by the Engineer to do so.

1.17 DELIVERY, STORAGE, AND HANDLING

- .1 Store and handle materials in accordance with Construction Plan and Manufacturer's written instructions.

1.18 SYSTEM STARTUP

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

1.19 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 shall provide drawings and specifications required by Provincial Electrical Inspection Department and Supply Authority at no cost.
- .4 Notify Engineer 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 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 Engineer.
- .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 Wording on nameplates to be approved by Engineer prior to manufacture.
.4 Allow for minimum of twenty-five (25) letters per nameplate.
.5 Identification to be in English.
.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 General: where a lamicoid identified item is installed in an accessible ceiling space, provide two nameplates. Install one nameplate at the item's location and a second nameplate on the underside of the ceiling directly below the item.

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.
.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	Green	Blue
Systems		
Fire Alarm	Red	
Security Systems	Red	Yellow

	Primary	Auxiliary
Public Address	Blue	
Data	Blue	White
Emergency Lighting & Exit Signs	(ac) Orange	White
Emergency Lighting & Exit Signs	(dc) Brown	White

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.
 - .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 pull stations: 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 and associated control equipment including sequenced operation of systems where applicable.
 - .4 Systems: fire alarm system, communications, security 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.

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 Engineer 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.

3.12 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 SECTION INCLUDES

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

1.2 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.
- .3 Section 26 05 21 – Wires and Cables 0-1000V.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International) Latest Edition of the following:
 - .1 CAN/CSA-C22.2, No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2 No.65 Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC) Latest Edition of the following:
 - .1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

Part 2 Products

2.1 MATERIALS

- .1 Pressure type wire connectors with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors to consist of:
 - .1 Connector body and stud clamp for stranded, copper conductors.
 - .2 Clamp for stranded copper conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
 - .5 Bolts for aluminum conductors.
 - .6 Sized for conductors as indicated.
- .4 Clamps or connectors for armoured cable, flexible conduit, as required.
- .5 Joints required in connecting all wiring up to and including # 8, are to be made using twist-on connectors.

- .6 Joints for all other wiring shall be made using colour-keyed compression type connectors followed by a layer of CSA approved vinyl plastic tape.

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 26 05 00 – Common Work Results – Electrical.
- .3 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.
- .4 Section 26 05 34 Conduits, Conduit Fastenings and Conduit Fittings.
- .5 Section 26 05 43 – Installation of Cables in Trenches and in Ducts.

1.2 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.

Part 2 Products

2.1 BUILDING WIRES

- .1 Conductors: stranded for #8 AWG copper and larger. Minimum size: 12 AWG.
- .2 Conductors: copper, size as indicated, with 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.
- .3 Neutral conductors insulated for 600V shall be continuous with no fuses, switches, or breaks of any kind. Neutral conductors shall be same size as phase conductors unless noted otherwise.
- .4 Wiring for specialized systems such as fire alarm and security shall be as indicated in other sections or on drawings.
- .5 The voltage drop in no case shall exceed 3% of the line volts for branch circuits.
- .6 Provide separate neutral for each circuit. Do not use common neutral conductors.

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 Use vibration proof expanding spring wire connectors for No. 10 and smaller.

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 – 2009, Canadian Electrical Code, Part 1.

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 conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.

- .6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .8 Bond single conductor, metallic armoured cables to cabinet at supply end, and 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: frames of motors, starters, control panels.

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.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

Part 2 Products

2.1 SUPPORT CHANNELS

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

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 m and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 51 m.
 - .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 Engineer.
- .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.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

Part 2 Products

2.1 JUNCTION AND PULL BOXES

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

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.

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.

Part 2 Products

2.1 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.

2.2 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.
- .2 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .3 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 MASONRY BOXES

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

2.4 CONCRETE BOXES

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

2.5 CONDUIT BOXES

- .1 Cast FS boxes with factory-threaded hubs and mounting feet for surface mounted devices.

2.6 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.

2.7 FITTINGS FOR EMT CONDUIT

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

2.8 FITTINGS IN WET OR DAMP LOCATIONS

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

2.9 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 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.

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.

Part 2 Products

2.1 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.

2.2 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.

2.3 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

- .7 35 mm and larger.
- .8 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

2.4 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 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 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 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 Minimum conduit size for lighting and power circuits: 16 mm.
- .9 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .10 Mechanically bend steel conduit over 22 mm dia.
- .11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

- .12 Install fish cord in empty conduits.
- .13 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .14 Dry conduits out before installing wire.
- .15 Securely fasten in place within 83 mm of each outlet box, junction box, cabinet, coupling or fitting, maximum spacing between supports as follows:
 - .1 1.5 m for 21 mm trade size conduit and smaller.
 - .2 2 m for 27 mm to 35 mm trade size conduit.
 - .3 3 m for 41 mm trade size and larger.
- .16 Ground Wires:
 - .1 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 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel:
 - .1 Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed:
 - .1 Use cold mastic between sleeve and conduit.
- .5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.

- .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

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 WORK INCLUDED

- .1 Contractor's work to include all labour, materials, tools, appliances, control hardware, sensors, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy and daylight sensor lighting control system, as described herein.
- .2 Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, fixtures, HVAC systems and building management systems.

1.3 SYSTEM DESCRIPTION

- .1 The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.
- .2 The occupancy sensor based lighting controls shall accommodate all conditions of space utilization and all irregular work hours and habits.
- .3 Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The suppliers obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier.

1.4 SUBMITTALS

- .1 Submit Shop Drawings in accordance with Section 26 05 00 – Common Work Results – Electrical.

1.5 SYSTEM OPERATION

- .1 It shall be the contractor's responsibility to make all proper adjustments to assure owner's satisfaction with the occupancy sensor system.

Part 2 Products

2.1 OCCUPANCY SENSOR TYPES

- .1 Refer to Legend on drawings.

2.2 ACCEPTABLE MANUFACTURERS

- .1 Watt Stopper, Leviton, Lightolier, Sensor Switch.
- .2 The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the electrical contractor to ensure that any price quotations received and submittals made are for sensors and power packs which meet or exceed the specifications included herein.

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 It shall be the contractor's responsibility to locate and aim sensors in order to achieve complete and proper volumetric coverage within each room indicated. Rooms shall have ninety five (95) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s).
- .2 The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.
- .3 Proper judgement must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.
- .4 The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.
- .5 Contractor shall adjust the time delay setting for each sensor to five minutes.

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 SECTION INCLUDES

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

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International) Latest Edition of the following:
 - .1 CSA-C22.2 No.42-99 (R2004), General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA-C22.2 No.42.1-00 (R2004), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA-C22.2 No.55-M 1986 (R2003), Special Use Switches.
 - .4 CSA-C22.2 No.111-00, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 26 05 00 – Common Work Results – Electrical.

Part 2 Products

2.1 SWITCHES

- .1 15A, 120V and 347V, single-pole, 3-way and 4-way switches, commercial specification grade to: CSA-C22.2 No.55 and CSA-C22.2 No.111.
- .2 Manually-operated general purpose ac switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Alloy contacts.
 - .3 High strength thermoplastic polycarbonate toggle.
 - .4 Suitable for side wiring.
 - .5 White toggle.
- .3 Toggle operated locking fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .4 Switches of one manufacturer throughout project.

- .5 Acceptable materials – single-pole switch (120V): Pass & Seymour CS15AC1-W; single-pole switch (347V): Pass & Seymour PS371510-W; 3-way switch: Pass & Seymour CS15AC3-W; 4-way switch: Pass & Seymour CSB15AC4-W.

2.2 RECEPTACLES

- .1 Duplex receptacles, CSA types 5-15 R and 5-20 RA 125V, U ground, commercial specification grade, to: CSA-C22.2 No.42 with following features:
 - .1 Impact resistant nylon face.
 - .2 Reinforced thermoplastic polyester thick wall base.
 - .3 Suitable for No. 10 AWG for back and side wiring.
 - .4 Break-off links for use as split receptacles.
 - .5 Eight back wired entrances, four side wiring screws.
 - .6 Triple wipe contacts and riveted grounding contacts.
 - .7 One piece brass mounting strap with integral ground contacts.
 - .8 Color: White.
 - .9 Isolated ground where indicated.
- .2 Duplex receptacles with USB ports, CSA types 5 15 R and 5-20 RA 125V, U ground, commercial specification grade, to: CSA C22.2 No.42 with following features:
 - .1 Same as paragraph 1 plus two USB charging ports, Type A and Type C.
- .3 GFCI Duplex receptacles, CSA types 5-15 R and 5-20 RA 125V, U ground, commercial specification grade, to: CSA-C22.2 No.42 with following features:
 - .1 Same as paragraph 1 plus Class A GFCI rating.
- .4 Receptacles of one manufacturer throughout project.
- .5 Acceptable Materials:
 - .1 Pass & Seymour CR15 (15A) and CR20 (20A T-slot).
 - .2 Isolated ground where indicated.
- .6 Acceptable Materials for GFCI Receptacles:
 - .1 Pass & Seymour 1595 (15A) and 2095 (20A T-slot).

2.3 COVER PLATES

- .1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.
- .2 Cover plates from one manufacturer throughout project.
- .3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .4 Cover plates for all flush-mounted switches and receptacles shall be white high impact resistant thermoplastic.

- .5 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

2.4 SPECIAL WIRING DEVICES

- .1 Other receptacles with ampacity and voltage as indicated on drawings.

2.5 ACCEPTABLE MANUFACTURERS

- .1 Pass & Seymour, Hubbell, Leviton, Cooper.

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

3.3 TESTS

- .1 Test each receptacle for polarity and retention of blades.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .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, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Submit certificate of origin for all new breakers.

Part 2 Products

2.1 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.

2.2 ACCEPTABLE MATERIALS

- .1 Breakers shall be compatible with existing panels in which they are to be installed.
- .2 All breakers provided under this contract shall be new and shall be covered by manufacturer's warranty.

- .3 Short circuit interrupting ratings of new breakers shall be equal to or greater than the interrupting rating of the panel in which they are installed.

2.3 ACCEPTABLE MANUFACTURERS

- .1 Square D.
- .2 Cutler-Hammer.
- .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 Install circuit breakers in existing panels as indicated.

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 American National Standards Institute (ANSI):
 - .1 ANSI C82.1-97, Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.
 - .2 ANSI C82.4-92, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.

1.3 SUBMITTALS

- .1 Submit shop drawings for each of the following:
 - .1 Luminaires.
 - .2 Drivers
- .2 Luminaire shop drawings shall indicate: housing construction, driver type, LED Module type, reflector type, lens type and photometrics.
- .3 LED module shop drawings shall indicate: initial lumens, mean lumens, CCT and CRI.

Part 2 Products

2.1 LAMPS

- .1 Refer to luminaire schedule on drawings.
- .2 Provide minimum 1 spare fixture for each fixture type.

2.2 BALLASTS

- .1 Not Applicable

2.3 LUMINAIRES

- .1 Refer to Luminaire Schedule on drawings.

2.4 ACCEPTABLE MANUFACTURERS

- .1 Luminaires: Refer to luminaire schedule on drawings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Locate and install luminaires as indicated.

3.3 WIRING

- .1 Connect luminaires to lighting circuits as indicated.

3.4 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations support luminaires independently of ceiling. Responsibility for providing support is with this Division.

3.5 LUMINAIRE ALIGNMENT

- .1 Align luminaries mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaries mounted individually parallel or perpendicular to building grid lines.
- .3 All flush trims on recessed pot lights to be flat/flush to finished ceiling.

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 International):
 - .1 CSA C860-01 (December 2002), Performance of Internally-Lighted Exit Signs.
- .2 National Fire Protection Association (NFPA):
 - .1 NFPA 101-2006, Life Safety Code.

1.3 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 26 05 00 – Common Work Results - Electrical.

Part 2 Products

2.1 STANDARD UNITS

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860.
- .2 Lamps: white LED, 25-year life, 5 watt max total consumption, solid-state board.
- .3 Pictogram type.
- .4 Extruded one piece aluminum housing. Color white.
- .5 Mounting as required.
- .6 Single and double face units.
- .7 Wall and ceiling mounted.
- .8 Supply voltage as per circuiting.
- .9 Face plate to remain captive for re-lamping.

2.2 ACCEPTABLE MANUFACTURERS

- .1 Aimlite, Emergi-Lite, Lumacell, Ready-Lite.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install exit lights as indicated in accordance with National Building Code (NBC) 2010.
- .2 Connect fixtures to exit light circuits as indicated.
- .3 Ensure that exit light circuit breaker is locked in ON position. Provide lock-on devices where required.
- .4 Confirm AC supply voltage prior to ordering.

END OF SECTION