

PART 1 - GENERAL

1.1 GENERAL

- .1 This Section covers items common to Sections of Division 26, 27 and 28. This section supplements requirements of Division 1.
- .2 Read this Section in conjunction with all other contract documents.

1.2 REFERENCES

- .1 CAN3-C235-83(R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000V.
- .2 CSA-C22.1-2015, Canadian Electrical Code, Part 1 (22nd edition), Safety Standard for Electrical Installations.
- .3 CSA Z85-1983, Abbreviations for Electrical Terms.
- .4 EEMAC Y1-2-1979, Standard for Performance Specification for Finishing Systems for Outdoor Electrical Equipment.
- .5 EEMAC 2Y-1-1958, Standard for CEMA Light Grey Colour for Indoor Switchgear.
- .6 CSA B44-10/ASME A17.1-2010, Safety Code for Elevators and Escalators.

1.3 CARE, OPERATION AND STARTUP

- .1 Instruct the Departmental Representative and operating personnel in the operation, care and maintenance of all equipment.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.4 VOLTAGE RATINGS

- .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. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 PERMITS, FEES AND INSPECTION

- .1 Submit to the Electrical Inspection Department, Municipal Authority and supply authority the necessary number of drawings and specifications, for examination and approval prior to commencement of Work.
- .2 Provide the Departmental Representative with a copy of the electrical Inspection Department and supply Authority Plans Review Report, immediately upon receipt. No shop drawings will be reviewed prior to receipt of the Plans Review Report from the Contractor.
- .3 Obtain all necessary permits including an Electrical Wiring Permit for electrical work and Communications Cabling Permit for communications cabling work from the authority having jurisdiction, prior to commencement of Work. Provide a copy of each permit to the Departmental Representative upon receipt. Display permits on the Work site.
- .4 Upon specific request, the Departmental Representative will provide, to the Contractor, up to a maximum of three (3) copies of the drawings and specifications required for submittal to the Electrical Inspection Department and Supply Authority. These drawings and specifications will be provided to the Contractor at no cost, unless otherwise specified.
- .5 Arrange for all required inspections to be conducted by the authority having jurisdiction. Provide a copy of all inspection reports to the Departmental Representative immediately upon receipt. Notify the Departmental Representative immediately of changes required by the authority having jurisdiction.
- .6 Furnish Certificates of Acceptance from authorities having jurisdiction upon completion of work. Include a copy in the Operation and Maintenance Manual.
- .7 Pay all associated fees for permits, fees and inspection.

1.6 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Section 01 61 00.
- .2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the authority having jurisdiction.
- .3 Factory assemble control panels and component assemblies.

1.7 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two (2) coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1.
 - .2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.8 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as specified herein.
- .2 Identification:
 - .1 Provide all switchboards, panels, disconnect switches, receptacles, voice/data/CATV/Multimedia outlets/P.A. Speakers, MCC's, transformers, control panels, fire alarm devices, magnetic starters, TOL's, etc. with lamicaid nameplates as further described herein. Affix all plates true and level, and plumb in all instances.
 - .2 Affix nameplates to metal surfaces with steel type pop-rivets.
 - .3 Affix nameplates to other types of surfaces with contact type cement.
 - .4 Affix nameplates to building exterior surfaces with nylon inserts and self-tapping screws unless specifically indicated otherwise.
 - .5 Apply contact type cement to complete rear side of plate, as opposed to several locations or areas on same.
 - .6 Lamicaid nameplates installed on distribution panelboards, motor control centres, splitter troughs and transformers to indicate the following:
 - .1 Designated name of equipment.
 - .2 Amperage of overcurrent protection device.
 - .3 Voltages, number of phases and wires.
 - .4 Designation of power source.

Example
PANEL A - 225 AMPS
120/208V - 3PH - 4W
FED FROM MAIN SWITCHBOARD 'SB-1'

- .7 Lamicaid nameplates installed on combination starters, magnetic starters, manuals starter and all various systems controls, control panels, disconnect switches, etc., to contain:
 - .1 Designated name of equipment.
 - .2 Designated name of power source.
 - .3 Branch circuit breaker number(s) where possible.
 - .4 Voltage(s).

EXHAUST FAN NO. 1 SUPPLY FAN NO. 1
PANEL A - CCT. NO. 10 M.C.C. NO. 1
120V - 1-Phase 600V - 3-Phase

- .8 Lamicaid nameplates installed on fusible type disconnect switches are to also indicate maximum designated/designed fuse size.
- .9 Install lamicaid nameplates on all junction and/or pull boxes sized 150 mm x 150 mm and larger indicating name of system, designated panel name and electrical characteristics where applicable.
- .10 Install lamicaid nameplates adjacent to each overcurrent devices located in switchboards, CDP panels, etc. They need only indicate designated name and/or

number of equipment they feed. Unused O.C. devices are to be identified as SPARE(S).

- .11 Lamicoid nameplates installed on main service entrance switches, or main entrance switchboards to indicate the following information on minimum size 150 mm x 50 mm plate complete with two (2) lines of 13 mm high lettering (Size #8 nameplate)

Example: Example:
MAIN BREAKER 400 AMPS MAIN SWITCH 400 AMPS
600/347V, 3PH, 4W 120/208V, 3PH, 4W

- .12 Install an additional lamicoid nameplate on all, or any piece of electrical equipment, or apparatus (i.e., Main Switchboard, CDP panels, Panelboards, Motor Control Centres. etc.), that contain overcurrent devices (i.e., circuit breakers and/or fuses), that have been designed for, and incorporate interrupting capacity greater than 10 kA I.C.

Example:
Min. interrupting capacity of breakers
installed in this panel to be not less
than 22 kA I.C.

Example:
Min. interrupting capacity of fuses
installed in this MCC to be not less
than 100 kA I.C.

- .13 Install lamicoid nameplates above all types of receptacles and abutted directly to tops of their respective device plates. Identification to indicate respective panel source complete with associated circuit breaker number(s) as per the following:

- .1 1.5mm x 13mm high complete with 6 mm black letters on white core, directly above all receptacles. Plate to be identical width as finish device plate.

Example: PANEL 'A' CCT.20

- .14 Identify receptacles intended for computer, electronic or other sensitive types of electronic equipment etc., as per following:

- .1 1.5mm thick x 19mm wide complete with 6 mm black letters on white core above all receptacles. Identical width as finish device plate.

Example: For computer use only
PANEL 'A' - CCT.24

- .15 Identify lamicoid nameplates above 120V receptacles protected by GFCI circuit breakers, or GFCI type receptacles as per the following:

- .1 1.5mm thick x 19mm wide complete with 6 mm black letters on white core above all receptacles. Identical width as finish device plate (EXAMPLE: GFCI Protected Panel 'A' CCT.24).

- .16 Apply lamicoid nameplate(s) for power/voice/data/CATV/CCTV/multimedia outlets/P.A. specific devices directly to face of finish plate.

- .1 1.5mm thick x 19mm wide complete with 6mm black letter on white cover above all receptacles. Identical width as finish device plate.
- .17 All addressable fire alarm devices are to be lamicon identified.
 - .1 Hang lamicon identification on chains on mechanical items (pressure switches, supervisory switches, etc.).
 - .2 Manual pull station lamicon plate to be similar to typical receptacle lamicon plate.
 - .3 Lamicon working to match physical location and annunciator display address.
- .18 Lamicon 3mm thick plastic engraving sheet, white face, black core, for all electrical systems except Fire Alarm: Fire Alarm to have red face with white core.
 - .1 1.5mm thick nameplates above receptacles as previously indicated, with top left and right corners to be rounded off.
 - .2 Lettering on lamicon nameplates shall not start, nor end nearer than 13mm from either, or both ends of said plates. Size of lettering, including overall lengths of various plates shall be as indicated in the following chart:

NAMEPLATE SIZES

Size 1	9mm x 50mm	1 line	5mm high letters
Size 2	13mm x 70mm	1 line	6mm high letters
Size 3	16mm x 75mm	2 lines	5mm high letters
Size 4	19mm x 90mm	1 line	9mm high letters
Size 5	6mm x 90mm	2 lines	13mm high letters
Size 6	25mm x 100mm	1 line	13mm high letters
Size 7	25mm x 100mm	2 lines	6mm high letters
Size 8	50mm x 150mm	2 lines	13mm high letters

- .3 Have the wording on nameplates and labels approved by Departmental Representative prior to manufacture.
- .4 Allow for average of forty (40) letters per nameplate and label.
- .5 Identification to be English.
- .6 Provide and install lamicon nameplates on, or adjacent to, all various systems' control panels, equipment racks and/or cabinets complete with information as indicated. Nameplates to reflect individual system's assigned name, and where applicable, indicate both designated panel name and associated branch circuit breaker number(s).
 - .1 Fire alarm panels
 - .2 Security (CCTV) units/panels
 - .3 Energy management racks/panels
 - .4 Television panels
 - .5 Communication racks/panels
 - .6 Low voltage lighting relay panels (EXAMPLE: LIGHTING RELAY PANEL #1 - LPA - 01).
 - .7 PA (Public Address) System.
- .7 Control Transformers:
 - .1 Concealed control transformers located within ceiling spaces to have lamicon nameplates installed adjacent to same indicating their identified system, primary

- power source including designated panel name, complete with associated branch circuit breaker number(s).
- .2 Install second plate with identical information on underside of room grid system or access opening frame directly below control transformer, so as to identify its concealed location directly above same.
 - .3 Identify control transformers installed in either control cabinets or on walls adjacent to same, with lamicoid nameplates containing information as previously indicated.
- .8 Junction and pull boxes: indicate system and voltage.
- .9 Co-ordinate names of equipment and systems with other trades to ensure that equipment identification is consistent.
- .10 In addition to required nameplates and colour coding, junction boxes to have the panel and circuit numbers of all wiring contained within listed on the coverplate. List to be neatly written using black indelible marker.
- .11 Colour code all electrical junction boxes, pull boxes, and conduit fittings as follows:
- .1 Apply colour coding prior to pulling conductors into boxes.
 - .2 Where primary colour only is indicated:
 - .1 Colour inside and outside of box.
 - .2 Colour all cover plates.
 - .3 Where primary and secondary colours are indicated:
 - .1 Paint inside and outside of box with the primary colour.
 - .2 Diagonally apply to each half of the cover plate the primary and secondary colours.

1.9 WIRING IDENTIFICATION

- .1 Identify wiring with self-laminating, permanently mechanically imprinted labels on both ends of each conductor and cable utilized. Identify conductors and cables in each junction or pull box through which they pass. Labels to be installed in a "flagged" manner around individual conductors.
- .2 Maintain phase sequence and colour coding throughout.
- .3 All conductors are to have their insulation colors identified as follows:

Phase A - Red
Phase B - Black
Phase C - Blue
Neutral - White
Bond - Green
Ground - Green
Isolated Ground - Green c/w yellow strip

- .4 Color coded Conductor Insulation as per the following:
- .1 All sizes of phase conductors up to and including #2AWG.
 - .2 All sizes of neutral, bond and/or ground conductors up to and including #3/0AWG.
 - .3 Approved colored tapes in lieu of insulation coloring may be used to identify conductors that exceed sizes as previously indicated. Labelling is to take place at both ends of all runs at a minimum of 300mm from terminations, in addition to within all boxes between both ends of the run.
- .5 Use colour coded wires in communication cables, matched throughout system.
- .6 Indicate panel and circuit number of all phase conductors e.g.: "Panel "P-1" - CCT.03". Identify all neutral conductors bonding and ground conductors to indicate the phase conductor with which they are associated.

1.10 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables. Boxes are to be coloured inside and outside where one colour is required. Boxes are to be coloured on inside only where two (2) colours are required. Metal cover plates are to have both colours applied diagonally where two (2) colours are required. Paint entire cover plate where one (1) colour is required.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15m intervals.
- .3 Colours: 25mm wide prime colour and 19mm wide auxiliary colour.

System	Colour	Primary Colour	Secondary Colour
0-50 volts		VIOLET	-
51 volts to 240 volts		YELLOW	-
241-600volts		ORANGE	-
Fire alarm		RED	-
Telephone (Voice only)		BLACK	-
Public Address and Intercom		BLUE	-
Ground or Bond		GREEN	-
Security		BROWN	-
Mech. Controls		RED	WHITE
Cable Television		YELLOW	WHITE
Computer (data only)		BLACK	WHITE
Voice and Data		BLUE	WHITE
CCTV		GREEN	WHITE

- .4 All various system junction and/or pull boxes etc., where located above ceiling grid system to have location identified on underside or room side of t-bar spline, with (19mm) or (6mm on 19mm) self adhering colour coded circular shaped discs, affixed directly to spline in close proximity to where concealed box is located. Intall the same type of discs on ceiling or wall access cover plates. 6mm discs are all white in colour. Affix 6mm to center or middle of of 19mm discs as system colours indicates.

	<u>Outer</u>	<u>Inner</u>	
Various Systems		19mm Discs	6mm Discs
0 to 50 volts	VIOLET		
51 to 240 volts	YELLOW		
241 to 600 volts	ORANGE		
Fire Alarm	RED		
Telephone (voice only)	BLACK		
P.A. and Intercom	BLUE		
Security	BROWN		
Ground or Bond		GREEN	
Cable Television	YELLOW	WHITE	
Energy Management		RED	WHITE
Computer (data only)	BLACK	WHITE	
Voice and Data	BLUE	WHITE	
CCTV		GREEN	WHITE
Other	BROWN	WHITE	

- .5 Provide a legend of colour coding, mounted under plexiglass cover. Install in main electrical room.

1.11 WIRING TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for copper conductors only.
- .2 Label all branch circuit wiring including phase conductors, neutral, ground and/or bonding conductors to be done on both ends of all circuit wires plus in any junction and pull boxes located between ends. Use write-on self-laminating labels. Wrap around conductor in a "U" fashion.

1.12 MANUFACTURERS AND CSA LABELS

- .1 Visible and legible after equipment is installed.

1.13 WARNING SIGNS

- .1 As specified and to meet requirements of Electrical Inspection Department and Departmental Representative.
- .2 Porcelain enamel decal signs, minimum size 170mm x 250mm.

1.14 SINGLE LINE ELECTRICAL DIAGRAMS

- .1 Provide single line electrical diagrams under plexiglass as follows:
 - .1 Electrical distribution system: locate in main electrical room and local electrical room.
 - .2 Include a legend of colour coding for the various systems identified in item 10-conduit and cable identification.
- .2 Drawings: Full drawing size from most recent drawing set, in main electrical room and 610mm x 610mm (minimum) size drawing in the penthouse.

1.15 LOCATION OF EQUIPMENT

- .1 Do not install outlets back-to-back in wall. Allow minimum 150mm horizontal clearance between boxes. Do not install boxes back to back in the same stud space wherever possible.
- .2 Change location of equipment at no extra cost or credit, providing distance does not exceed 3m, and information is given before installation.
- .3 Locate light switches on latch side of doors unless otherwise indicated. Locate disconnect devices in mechanical and elevator machine rooms on latch side of the door.

1.16 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or otherwise indicated.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Mounting heights for devices to conform to NBC and NS Building Code regulations for Barrier Free design.
- .4 Install electrical equipment at following heights unless otherwise indicated.
 - .1 Local switches: 1200mm
 - .2 Wall receptacles:
 - .1 General: 460mm
 - .2 Above top of continuous baseboard heater: 200mm, minimum 460mm AFF.
 - .3 Above top of counters or counter backsplash: 150mm
 - .4 In mechanical rooms: 1200mm
 - .5 Exterior Receptacles: 1000mm
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Wall mounted telephone, data and CATV outlets:
 - .1 General: 460mm
 - .2 Above top of continuous baseboard heater: 200mm, minimum 460mm AFF.
 - .3 Above top of counters or counter backsplash: 150mm
 - .4 In mechanical rooms: 1200mm
 - .5 Fire alarm stations: 1200mm
 - .6 Fire alarm signals: 2300mm
 - .7 Security keypads: 1200mm

- .8 Pin/Prox readers: 1200mm
- .9 Wall mounted motion sensors: 150mm below finished ceiling.

1.17 LOAD BALANCE

- .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Submit, at completion of Work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.18 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe or plastic, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.
- .4 Arrange and pay for holes through exterior walls and roof to be flashed and made weatherproof.

1.19 FIRESTOPPING

- .1 Provide firestopping and smoke sealing of all cable, cabletrough or conduit penetrations through fire resistant separations as specified in Section 07 84 00.

1.20 FIELD QUALITY CONTROL

- .1 Conduct and pay for following tests:
 - .1 Distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .5 Systems: fire alarm system and lighting control system.
- .2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .3 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 Carry out tests in presence of Departmental Representative.

- .5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

- .6 Submit typed test results for Departmental Representative's review and inclusion in the Operation and Maintenance Manual.

- .7 Confirm circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not applicable.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 CSA C22.2 No. 65-2013, Wire Connectors, Tri-National Standard, with UL 486A-486B and NMX-J-543-ANCE-03.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required. Provide for all panels including main switch board and main transformer.
- .2 Fixture type splicing connectors: with current carrying parts of copper and copper alloy sized to fit copper conductors #10 AWG or less.
- .3 Clamps or connectors for armoured cable, liquid tight flexible metal conduit.

PART 3 - EXECUTION

3.1 MATERIALS

- .1 Make connections and terminations electrically and mechanically secure. Sizes of connectors to be as per manufacturer's recommendations for various sizes and combinations of wire sizes.
- .2 Make joints required in branch wiring #10 and smaller utilizing "twist-on" type connectors as manufactured by "Ideal" (colour coded wirenut) of "Marrettes" #31, #33 or #35, or approved equivalents.
- .3 Make joints for all other wiring utilizing "Thomas & Betts" colour keyed compression type connectors #5400 series c/w TBM series compression tools. A first layer of compound type tape to be followed by an additional layer of "Scotch" #33 vinyl tape. Approved alternative for wire connections up to, and including #6 may be colour coded wing-nut as manufactured by "Ideal".
- .4 Plier tighten marrette type connectors.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 CSA C22.2 No. 0.3-09(R2014), Test Methods for Electrical Wires and Cables.
- .2 CSA C22.2 No. 208-2014, Fire Alarm and Signal Cable.
- .3 CSA C22.1-2015, Canadian Electrical Code (CEC).

1.2 PRODUCT DATA

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

1.3 OPERATION AND MAINTENANCE DATA

- .1 Submit operation and maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 RELATED WORK

- .1 Electrical General Requirements: Section 26 05 00.

PART 2 - PRODUCTS

2.1 BUILDING WIRES

- .1 Conductors: soft drawn stranded copper (of 98% conductivity). Minimum size: #12 AWG.
- .2 Copper conductors sized as indicated or as required by C.E.C., with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90-XLPE.
- .3 Copper conductors sized as indicated or as required by C.E.C., with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RWU90-XLPE.

2.2 TECK 90 CABLE

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

- .2 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene rated type RW90, 600V.
- .3 Inner jacket: polyvinyl chloride material.
- .4 Armour: interlocking aluminum.
- .5 Overall covering: polyvinyl chloride (PVC), heat, flame and moisture resistant material.
- .6 Connectors:
 - .1 Non-hazardous areas: Thomas & Betts Star Teck aluminum connectors or Crouse-Hinds or Appleton approved equivalent, complete with aluminum locknut.
- .7 Multi-conductor TECK cable ampacity is to be de-rated in accordance with the Canadian Electrical Code (based on number of conductors in cable assembly, ambient temperature, etc.).

2.3 ARMoured CABLES

- .1 Conductors: 600 V insulated (RW90 XLPE), copper (of 98% conductivity), size as indicated, minimum #12 AWG.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Connectors: designed for cable.

2.4 CONTROL CABLES

- .1 Type LVT: two (2) soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.
- .2 Control circuit wiring 50V and less: CAT 6 (colour to suit system, see Section 26 05 00). FT6 rated when run in free-air.

2.5 FIRE ALARM CABLES

- .1 Type FAS 105 to CSA C22.2 No. 208, PVC insulation, size and quantity of conductors as indicated, 105°C flame retardant, Red PVC outer jacket. FT6 rated.

PART 3 - EXECUTION

3.1 VOLTAGE DROP

- .1 Unless cable or wire sizes are indicated or noted on the electrical drawings, all 15A, 120VAC branch circuits size based on the following table. Length includes vertical drop. De-rated multi-conductor TECK cable sizes, if larger, will supersede the following table.

0-20m	#12 AWG
21-35m	#10 AWG
36-55m	#8 AWG
56-90m	#6 AWG
91-140m	#4 AWG
141-180m	#3 AWG
181-215m	#2 AWG

3.2 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
- .1 In conduit systems in accordance with Section 26 05 34.
- .2 The feeder neutral for all new branch circuit panels must be rated to 200% of phase conductors.

3.3 INSTALLATION OF TECK 90 CABLE - 1000V

- .1 Install cables where indicated on drawings and herein. All mounting hardware will be galvanized steel.
- .2 Group cables wherever possible on hanging assemblies, as specified in Section 26 05 29.
- .3 Support cables independently of supports used for equipment of other trades; do not support from, or secure cables to any mechanical piping.
- .4 Install cables in neat and professional manner, so as to conserve headroom.
- .5 Cables to enter all wall mounted equipment from the top.
- .6 Do not locate cables less than 300mm parallel to steam or hot water lines with minimum 100mm at crossovers.

3.4 INSTALLATION OF FIRE ALARM CABLES

- .1 Install fire alarm cables in metallic conduit (EMT, unless otherwise indicated).

3.5 INSTALLATION OF ARMoured CABLES

- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.
- .3 Install AC-90 cable as per the following guidelines:
 - .1 AC90 will only be permitted for branch circuit wiring drops from ceiling junction boxes to light fixtures, within the same room requiring electrical power. The installation of AC90 cable for branch circuit wiring home runs or runs between rooms is not acceptable.
 - .2 The grouping together of AC-90 cables to form a bundle for securing purposes is acceptable providing the following procedures are adhered to:
 - .1 In addition to securing type AC-90 cables at 1.5m intervals to structure, multiple or bundled groups of armoured cables must be tie-wrapped together at mid-point between each structure support, or every 760mm and secured to structure at 1.5m intervals, and also secured together (between each structure point) at 1.5m intervals.
 - .2 Limit grouping of AC-90 cables to a maximum of eight (8) current carrying conductors, including associated oversized neutral conductors where phase sharing occurs.
 - .3 The following examples incorporate uses of both, common and dedicated (separate) branch circuit neutral conductors:
 - .1 Maximum of two (2) runs of #12/4 conductor cables, including common (oversized) branch circuit neutral in each.
 - .2 Maximum of two (2) runs of #12/3 conductor cables, including (oversized) branch circuit neutrals (if not 3 phase, 3 wire), plus one run of #12/2 cable.
 - .3 Maximum of four (4) runs of #12/2 conductor cables, each including a separate, dedicated branch circuit neutral conductor.
 - .4 Where dedicated or separate branch circuit neutral conductors are non-phase sharing, they need not be sized larger than phase conductors they accompany unless specifically indicated otherwise.
 - .5 Originate AC-90 fixture feeds from the sides of outlet boxes and not from the box cover. Where three (3) and/or four (4) fixture drops extend from any one outlet box, the box must not be sized smaller than 119mm² square.
 - .6 A fixture drop is defined as that portion of AC-90 cable or flexible conduit being used to make final connection between accessible type junction or outlet box located in ceiling space (above T-Bar ceiling only) and its respective light fixture.
 - .1 Fixture drops are not to exceed 4.5m in total length unless specifically indicated otherwise.
 - .2 Do not feed more than four (4) drops from any one box regardless of its size. Secure AC-90 cables used for fixture drops within 300mm of the junction box. Provide each light fixture complete with its own separate fixture drop originating from a junction box located within same ceiling of room as fixture. An exception will be recessed down lights which may be wired from one fixture to another if they have integral junction boxes and the luminaire access opening is 150mm or greater in diameter.
 - .3 Wire light fixtures with a separate whip emanating from an overhead junction box within a T-bar ceiling space.
 - .4 #12 AWG type AC-90 armoured cables may be used where total fixture drop loads do not exceed the following:

- .1 Maximum of 5000 watts @ 347 volts using #12 AWG drop.
- .2 Maximum of 1800 watts @ 120 volts using #12 AWG drop.
- .7 Provide separate pig-tail type leads in each light fixture junction/outlet box for final connections to fixture drops. Connect pig-tail leads to light fixture line and associated neutral conductors.

3.6 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit.
- .2 Ground control cable shield where required.
- .3 Install insulated bonding conductor (minimum #12AWG Stranded Copper, green RW90 insulation) in conduit for control systems less than 50V.

3.7 INSTALLATION OF CABLES: GENERAL

- .1 Support cables independently of supports used for equipment of other trades; do not support from or secure cables to ductwork, piping and ceiling hanger wires.
- .2 Do not lay cables on top of suspended ceiling grids and tiles.
- .3 Install cables in a neat and professional manner, so as to conserve headroom. Inspection will be by the Departmental Representative. Correct any unacceptable Work at no cost to the Contract.
- .4 Install cables parallel and perpendicular to building lines.
- .5 Secure cables to underside of metal decking wherever practicable.
- .6 Exposed wiring at panels to be neatly marshalled from panel to finished ceiling space using suitably sized (minimum 450mm wide) ladder type cable tray.
- .7 Ty-rap branch circuit phase conductors and neutral (where applicable) at the closest point of entry within all panelboards, pull boxes, junction boxes, MCC's and switchboards.
- .8 Twist together stranded conductors at each termination.
- .9 Do not notch or cut structural members of wood frame construction to accommodate wiring installation.
- .10 Provide mechanical protection as required to protect wiring from damage from mechanical fasteners (nails, screws etc.).
- .11 Drill individual holes for wiring and cables penetrating wood frame floor joists. Locate holes in centre third of joist depth. Space holes a minimum of 25 mm and not less than one diameter apart.

- .12 Obtain permission of Departmental Representative prior to drilling where more than four (4) holes must be clustered or adjacent to structural connections.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 CSA C22.2 No. 41-2013, Grounding and Bonding Equipment (Bi-National Standard with UL 467).

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 Clamps for grounding of conductor: size as required and suitable for application.
- .2 Rod electrodes: galvanized steel 19mm dia by 3m long.
- .3 Direct buried grounding conductors: bare stranded copper of 98% conductivity, soft annealed, size as indicated.
- .4 Insulated grounding and bonding conductors: soft drawn stranded copper of 98% conductivity, type RW90 (green coloured insulation as indicated in 26 05 00, item 9 - Wiring Identification).
- .5 Ground bus: copper, minimum size 6mm x 75mm x 600m size and as indicated, complete with insulated supports, fastenings, connectors.
- .6 Ground connections to take place on the ground bus are to be as follows:
 - .1 For wire sizes #6 AWG and smaller: copper, one-hole, short barrel (single crimp) lugs.
 - .2 Wire larger than #6 AWG to be two-hole, long barrel (dual crimp) lugs.
- .7 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Bonding jumpers, straps.
 - .5 Pressure wire connectors.
- .8 Copper compression type, long barrel, two hole type lugs unless specified otherwise.
- .9 Copper compression type connectors (cable to cable, cable to ground rod, etc.).

2.2 MANUFACTURERS

- .1 Acceptable manufacturers: FCI-Burndy Corporation, Erico Inc., Thomas & Betts, IlSCO.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Conform to the requirements of the Departmental Representative, applicable codes and the local electrical inspection authority having jurisdiction.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to electrodes using copper welding by thermit process or inspectable copper crimp type compression connectors.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs except grounding terminations in 600V switchboards, 600V CDP panels, 600V MCC's to be copper, compression type, long barrel, two hole connectors.
- .6 Soldered joints not permitted.
- .7 Install insulated bonding conductor in all conduits.
- .8 Make grounding connections in radial configuration only, with connections terminating at single grounding point as indicated. Avoid loop connections.
- .9 Secure 'feed' bonding conductor (wrapped around unbroken) to the grounding screw of each outlet/device box, before connecting to the other grounding conductors and/or providing a "pig-tail" lead for device terminations.
- .10 Twist together all ground/bond wires with a screw-on type wire connector, and then place in the rear of the outlet box.
- .11 Bond EMT wall stubs or sleeves to ground as per the latest CEC requirements.

3.2 ELECTRODES

- .1 Install rod electrodes and make grounding connections.
- .2 Bond separate, multiple electrodes together.
- .3 Use size #2/0 AWG copper conductors for connections to electrodes unless otherwise indicated.
- .4 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.3 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of secondary systems.

3.4 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list: service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, cellular floor headers and cells and fittings, distribution panels, outdoor lighting, metallic waste water piping systems, metallic rain water leader systems, metallic gas fuel piping systems.

3.5 GROUNDING BUS

- .1 Where existing electrical rooms and telecommunications rooms are provided with a ground bus, make ground connections to that bus.
- .2 Ground items of electrical equipment to ground bus as indicated herein and on the Drawings.

3.6 COMMUNICATION SYSTEMS

- .1 Telecommunications: provide grounding and bonding in accordance with BICSI Telecommunications Distribution Methods Manual (TDMM), 12th Edition.

3.7 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Electrical General Requirements.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Where applicable, disconnect ground fault indicator during tests.

END OF SECTION

PART 1 - GENERAL

1.1 NOT USED

- .1 Not applicable.

PART 2 - PRODUCTS

2.1 SUPPORT CHANNELS

- .1 U shape, size 40mm x 40mm, 2.7mm thick galvanized steel, surface mounted, suspended or set in poured concrete walls and ceilings unless otherwise indicated.
- .2 Standard rolled structural steel shapes, plates and pre-fabricated components to form a complete assembly.

2.2 CABLE TIES

- .1 The use of cable ties for supporting purposes is not permitted. Cable ties can only be used to hold various system cables in place.
- .2 Nylon flame retardant, low smoke cable tie. Size as required.
- .3 Nylon flame retardant, low smoke cable tie mounting bracket. Mechanical fastening type only; adhesive mounts not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Do not support equipment from T-bar ceiling support. Provide independent supports as necessary.
- .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 within a maximum of 1m of each outlet box, junction box, pull box, cabinet or conduit fittings with spacing between supports as per CEC to building construction, conduit type and support system using straps.
 - .1 One-hole straps to secure surface conduits and cables smaller than 41mm.
 - .2 Two-hole straps for conduits and cables 41mm and larger.
 - .3 Conduit straps to be zinc plated steel.
- .7 Suspended support systems for conduits:
 - .1 Support individual conduit runs with minimum 12mm dia. continuously threaded rods and spring clips.
 - .2 Support two (2) or more conduits on u-shaped support channels supported by minimum 12mm dia. threaded rod hangers (trapeze style) where direct fastening to building construction is impractical.
 - .3 Continuously threaded rods to be zinc plated steel.
 - .4 Space channels in accordance with the CEC for the smallest conduit installed (maximum 1.5m spacing).
 - .5 Install washer and nut on both upper and underside of channel.
- .8 For surface mounting of two (2) or more conduits, use channels spaced at 1.5m (center-to-center) spacing (maximum).
- .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 Confirm adequate support for raceways and cables, drop vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or cable ties to support or secure raceways or cables.
- .12 Do not use non-electrical equipment supports or equipment installed for other trades for conduit or cable support.
- .13 Install fastenings and supports as required for each type of equipment, cables and conduits, and in accordance with manufacturer's installation recommendations.
- .14 Fasten individual and multiple runs of armoured cables to structure and in bundles using cable ties as permitted in 26 05 21 - Wire and Cables 0-1000 Volts.
- .15 Support various suspended types of junction, pull and/or outlet boxes as well as conduits, with minimum size 9 mm threaded rod, nuts and flat washers. Secure threaded rods to boxes with one (1) flat washer and nut installed on both sides of box.
 - .1 One (1) rod required for all type boxes sized 150mm x 150mm and smaller (22,500mm² and smaller).
 - .2 Two (2) rods required for boxes sized 22,500mm² and larger, up to and including those sized 300mm x 300mm (90,000mm²).
 - .3 Minimum of four (4) rods required for all boxes sized larger than 90,000mm²
 - .4 Cut-off excess rod within 13mm of channel bottom.
- .16 In addition to C.E.C. minimum conduit spacing requirements, all suspended conduit runs containing horizontal or vertical elbows are to have one additional support rod installed not greater than 300mm from mid-point of all 90° bends.

- .17 Maximum spacings between conduit support channels shall be as dictated by smallest size conduit(s) being supported and/or secured to same.
- .18 Touch up all field cut galvanized steel supports with galvanizing paint.

END OF SECTION

PART 1 - GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

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

PART 2 - PRODUCTS

2.1 SPLITTERS

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Main and branch lugs or connection bars to match required size and number of incoming and outgoing conductors as indicated.
- .3 Provide at least three (3) spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION AND PULL BOXES

- .1 Type C: welded steel construction, hinged cover, catch with hasp. Provision for locking. Surface or flush mounting as indicated.
- .2 Type D: welded steel construction with screw-on flat covers for surface mounting. Size cover a minimum of 25mm larger than the actual box dimensions. Surface or flush mounting as indicated.
- .3 Junction and pull boxes larger than 125mm x 125mm shall be Type "E", complete with continuously hinged door. Provide junction and pull boxes 125mm x 125mm and smaller complete with screw cover.
- .4 Covers with 25mm minimum extension all around, for flush-mounted pull and junction boxes.
- .5 Single gang sectional type devices boxes being used in steel stud walls for the installation of both metallic and non-metallic type cables, shall not be sized smaller than 250mm, complete with wrap around type bracket.
- .6 Two (2) or more flush installed sectional boxes ganged together, or boxes sized 100mm and larger (intended for devices) are to have an additional support bracket installed on opposite side of box not presently secured to metal stud.

2.3 CABINETS

- .1 Type E: sheet steel, hinged screw-to-lock, door and return flange overlapping sides, handle, and catch, for surface mounting.

2.4 EXTERIOR CABINETS

- .1 NEMA 4X, hinged screw-to-lock door for surface mounting.

PART 3 - EXECUTION

3.1 SPLITTER INSTALLATION

- .1 Install splitters and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2m above finished floor.
- .3 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30m of conduit run between pull boxes.
- .4 Where located above accessible ceiling systems, locate enclosures within 760mm of ceiling.
- .5 Suspend enclosures on 9mm plated steel threaded rod or rods secured to enclosure with one flat washer and one nut on both sides of box. Refer to Section 26 05 29 for number of threaded rods.
- .6 Junction or outlet boxes feeding a maximum of two fixture drops must not be sized smaller than 100mm square.
- .7 Concealed boxes located in the ceiling spaces above suspended type ceilings are not to be installed greater than 762mm above the finished ceiling elevation.
- .8 Junction boxes larger than 150mm x 150mm used in branch circuit wiring are to be complete with bonding terminal stripes.
- .9 Bond all metallic pull boxes with bonding conductor.

3.3 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 CSA C22.1-2015, Canadian Electrical Code, Part 1.

PART 2 - PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 100mm 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 76mm x 50mm x 38mm or as indicated. 100mm square outlet boxes when more than one conduit enters one side with extension and tile rings as required.
- .2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 100mm x 54mm x 47mm.
- .3 100mm square or octagonal outlet boxes for lighting fixture outlets.
- .4 100mm square outlet boxes with extension and tile rings for flush mounting devices in finished 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 FIRE RATED POKE TROUGHS

- .1 Fire rated poke troughs are specified on drawings.

2.6 CONDUIT BOXES

- .1 Cast FS or FD ferrous boxes with factory-threaded hubs and mounting feet for all surface wiring of switches, receptacle, thermostats and similar devices mounted.

2.7 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 35mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of Work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- .5 Install flush mounted boxes in all finished areas unless otherwise indicated.
- .6 Install surface mounted boxes in service rooms and above ceilings unless otherwise indicated.
- .7 Install flush mounted boxes in outside of exterior walls unless otherwise indicated.

- .8 Install type FS or FD boxes for all outlets (regardless of system type involved) to be surfaced mounted.
- .9 Install concealed boxes in accessible locations.
- .10 Flush installed 100mm or 120mm square box being used as a pull box or junction box to have installed a single or double gange tile ring and blank cover installed on the box.
- .11 Do not use sectional type boxes with rigid galvanized steel conduit, rigid PVC conduit or EMT.
- .12 Connect boxes to AC-90 cables specifically made for only AC-90 cables.
- .13 In metal drywall partitions, install a short piece of metal stud (same width as wall) on non-supported side of box and secure to box.

END OF SECTION

PART 1 - GENERAL

1.1 LOCATION OF CONDUIT

- .1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

1.2 REFERENCES

- .1 CSA C22.2 No. 45.1-07(R2012), Electrical Rigid Metal Conduit - Steel (Tri-National Standard, with UL 6 and NMX-J-534-ANCE-2007).
- .2 CSA C22.2 No. 56-2013, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .3 CSA C22.2 No. 83-1985(R2013), Electrical Metal Tubing.
- .4 CSA C22.2 No. 211.2-2006(R2011), Rigid PVC (Unplasticized) Conduit.

1.3 TRADE SIZE

- .1 The following are Metric trade sizes and Imperial trade size equivalent based on CEC Metric Units.

<u>Metric (mm)</u>	<u>Imperial (inch)</u>
12	3/8
16	1/2
21	3/4
27	1
35	1-1/4
41	1-1/2
53	2
63	2-1/2
78	3
91	3-1/2
103	4
129	5
155	6

1.4 RELATED WORK

- .1 Section 26 05 29: Fastenings and Supports.

PART 2 - PRODUCTS

2.1 CONDUITS

- .1 Rigid galvanized steel threaded conduit, fittings and connectors: to CSA C22.2 No. 45.1.
- .2 Electrical metallic tubing (EMT) with steel set screw couplings: to CSA C22.2 No. 83.
- .3 Rigid PVC conduit, fittings; couplings and connectors: to CSA C22.2 No. 211.2.
- .4 Flexible aluminum conduit and liquid-tight flexible metal conduit: to CSA C22.2 No. 56.

2.2 CONDUIT FASTENINGS

- .1 Use one (1) hole straps to secure surface conduits smaller than 41mm. Use two (2) hole straps for conduits 41mm and larger. Use straps that are zinc plated (galvanized) steel.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two (2) or more conduits at 1.5m oc.
- .4 12mm dia. threaded rods to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Conduit fittings (LB, LL and LR) are to be used for 90° bends. "Ells" or corner pulling "Elbows" are prohibited.
- .3 Connectors, fittings and couplings for EMT: use steel set-screw type.
- .4 Rain-tight or waterproof type connectors shall be used on all vertical conduit runs to connecting equipment in areas with sprinkler heads.
- .5 Screw on plastic or metal (malleable) type bushings for conduit ends.

2.4 SURFACE FLOOR MOUNTED RACEWAY

- .1 Low profile ADA compliant surface raceway for floor mounting.
- .2 Complete with moisture resistant floor transition ramps, aluminum bottom tracks, wire management clips, concrete screws, extruded aluminum wireway and top cap and power/telecom devices as indicated on drawings.

- .3 Include all components as required for neat transition up to walls. Coordinate with the removal partition wall supplier for best solution for this transition.
- .4 To be mounted under the carpet with the top cap flush for the carpet tile for easy access to cables.

2.5 FISH CORD

- .1 Polypropylene: minimum 3mm diameter.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass. Install as high as possible to underside of structure.
- .2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .3 Use electrical metallic tubing (EMT) in dry areas and where not subjected to damage. Do not use EMT in cast concrete.
- .4 Use rigid hot dipped galvanized steel threaded conduit outdoors, in wet/damp areas (water entry and pilot plant rooms) and where subjected to damage.
- .5 Use rigid PVC conduit underground and below concrete floor slabs: minimum size 27mm dia.
- .6 Use liquid tight flexible metal conduit for connection to motors and other vibrating and/or mechanical equipment including but not limited to the following: dry type transformers, valves, motorized dampers, unit heaters, chillers, HVAC equipment, sprinkler system controls, etc.
- .7 Minimum conduit size for lighting, power and control circuits: 21mm.
- .8 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .9 Mechanically bend steel conduit over 21mm dia.
- .10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .11 Install fish cord in empty conduits.
- .12 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.

- .13 Dry conduits out before installing wire.
- .14 Install insulated copper bonding conductor in all conduit runs. Minimum size: #14 AWG or Table 16 of C.E.C. whichever is larger.
- .15 Non-connected PVC or steel raceways protruding up through open bottoms of free-standing equipment require PVC bell ends and steel type "ground bushings" installed on ends of respective types of conduits.
- .16 Install bushings in all EMT and rigid galvanized steel conduits sized 21mm and larger before pulling in conductors.
- .17 Rain tight EMT connectors and couplings are to be used on the vertical portion of conduit runs where terminating into tops of electrical equipment in areas with sprinkler heads and in wet areas.
- .18 Rigid PVC conduit shall be FT6 rated.
- .19 Install a conduit drop to each flush installed device box in all walls. For cables to be run in free air (telecommunications, etc.), stub the conduit out of the wall into the accessible ceiling space of the room containing the flush installed device box.
- .20 For EMT wall stubs, install steel EMT connectors complete with plastic or grounding type bushings screwed on same. CSA approved EMT plastic end cap bushings may also be used.
- .21 Adequately bond conduit wall stubs and associated boxes to ground per CEC requirements.

3.2 SURFACE FLOOR RACEWAY

- .1 Layout the installation per the manufacturer recommendations.
- .2 Install the bottom track and transitions ramps perpendicular to walls.
- .3 Provide transition adaptors at walls.
- .4 Install power/ telecom devices under tables where indicated.

3.3 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Conduits to be installed above the bottom of the concrete ceiling drop panel.

3.4 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.

- .2 Waterproof joints (PVC accepted) with heavy coat of bituminous paint.
- .3 Where RPVC conduits emerge above floors, provide mechanical protection as required but not less than to a minimum of 150 mm above the slab.
- .4 Install below slab conduits in trenches not less than 300mm from underside of concrete floor slab to bottom of trench. Provide minimum 50mm of freshwater sand all around conduits.

END OF SECTION

PART 1 - GENERAL

1.1 SHOP DRAWINGS

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

1.2 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for panelboards for incorporation into manual specified in Section 01 78 00 – Closeout Submittals
- .2 Include panel schedules.

PART 2 - PRODUCTS

2.1 PANELBOARDS

- .1 Panelboards: product of one manufacturer.
- .2 250 and 600 V panelboards: bus and breakers rated as indicated.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Provide two keys for each panelboard, and key panelboards alike.
- .6 Tin-plated copper bus. Neutral bus to have same rating as mains, except where noted otherwise.
- .7 Panelboards identified with the "SN" prefix (e.g. 'SN1C') shall have 200%-rated neutral bus.
- .8 Mains: suitable for bolt-on breakers.
- .9 Trim with concealed front bolts and hinges.
- .10 Trim and door finish: baked grey enamel.
- .11 Minimum of one terminal screw on factory installed neutral bar for each circuit breaker position.

- .12 Panelboards rated 225A and below shall be minimum 508 mm wide.
- .13 Panelboards rated above 225A shall be minimum 279 mm deep and 914 mm wide, complete with drip hood.

2.2 BREAKERS

- .1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Lock-on devices for 10 % of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to the Departmental Representative.
- .5 Breakers installed in panelboards rated above 225A shall be capable of being padlocked in the on or off position.

2.3 EQUIPMENT IDENTIFICATION

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

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces. Provide plywood backboards as per Section 26 05 00 - Electrical General Requirements.
- .2 Mount panelboards to height specified in Section 26 05 00 - Electrical General Requirements or as indicated.
- .3 Connect loads to circuits.
- .4 Connect neutral conductors to common neutral bus with respective neutral identified.
- .5 Where more than one bonding terminal strip is present in one panel, both shall be hardwired together using same size bonding conductor as the one that accompanies the panel feeder conductors.

3.2 COMMISSIONING

- .1 Refer to Section 01 91 13 – General Commissioning.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 CAN/CSA C22.2 No. 42-10, General Use Receptacles, Attachment Plugs and Similar Wiring Devices.
- .2 CAN/CSA C22.2 No. 55-M1986(R2012), Special Use Switches.
- .3 CAN/CSA C22.2 No. 111-10, Standard-use Snap Switches (Bi-National Standard with UL 20).

1.2 SHOP DRAWINGS

- .1 Submit shop drawings for each device and coverplate type as per specification Section 01 33 00.

1.3 OPERATIONAL AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for wiring devices for incorporation into manual specified in Section 01 78 00.

PART 2 - PRODUCTS

2.1 SWITCHES AND SENSORS

- .1 Design S1:
 - .1 20A, 120V, specification grade single pole or two way switches as indicated.
 - .2 Manually-operated general purpose AC switches with following features:
 - .1 Terminal holes approved for #10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine molding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 White nylon, heavy duty toggle.
 - .6 Integral ground terminal.
 - .3 Toggle operated 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.
- .2 Design S2 (Controlled Receptacles):
 - .1 Occupancy sensor for control of receptacle loads.
 - .2 Complete with compatible 120V, 20A switching relay, rated for receptacle load.

- .1 Tested to 1.5 million cycles.
 - .2 ULC listed and CSA.
 - .3 Mechanically held relay rated 20A.
 - .4 ASHRAE 90.1 compliant.
- .3 Occupancy sensor to be compatible with the associated switching relay.
- .3 Design S3 (Vacancy Switch):
- .1 Vacancy dual technology wall switch.
 - .1 White in color
 - .2 Capable of switch 347V (or provide aux power pack where required).
 - .3 Complete with Decora coverplate
 - .4 Five (5) year warranty.
 - .5 Power failure recovery automatically
- .4 Design S4 (0-10V Dimmer):
- .1 0-10V Wall switch dimmer.
 - .1 White in color
 - .2 Capable of switch 347V (or provide aux power pack where required).
 - .3 Complete with Decora coverplate
 - .4 Five (5) year warranty.
 - .5 Power failure recovery automatically
 - .2 Occupancy sensor to be compatible with the associated switching.

2.2 RECEPTACLES

- .1 Design R1:
 - .1 General purpose duplex receptacles, specification grade CSA type 5-15R, 125V, 15A, U-ground, with following features:
 - .1 White urea molded housing.
 - .2 Suitable for #10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight (8) back wired entrances, four (4) side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
 - .6 Isolated ground receptacles where indicated.
 - .7 White nylon face.
- .2 Design R2:
 - .1 Duplex receptacles, specification grade CSA type 5-20 R(T-Slot), 125 V, 15/20A, U ground, with following features:
 - .1 White urea molded housing.
 - .2 Suitable for #10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight (8) back wired entrances, four (4) side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
 - .6 Isolated ground receptacles where indicated.
 - .7 White nylon face.
- .3 Design R3:
 - .1 GFI duplex controlled receptacles. Specification grade, CSA type 5-20R(T slot), 125V, 20A, U-Ground with the following features:
 - .1 White urea moulded housing.
 - .2 Suitable for #10 AWG for back and side wiring.
 - .3 Eight (8) back wired entrances, four (4) side wiring screws.
 - .4 Triple wipe contacts and riveted grounding contacts.
 - .5 White nylon face.
 - .6 GFI test and reset buttons.
 - .7 Leakage current: Class A, 5mA.
 - .8 Provide "Controlled" labeling on face.
- .4 Design R4:
 - .1 GFI duplex receptacles: Specification grade, CSA type 5-20R(T-Slot), 125V, 15/20A, U-ground with the following features:
 - .1 White urea moulded housing.
 - .2 Suitable for #10 AWG for back and side wiring.
 - .3 Eight (8) back wired entrances, four side wiring screws.
 - .4 Triple wipe contacts and riveted grounding contacts.
 - .5 White nylon face.
 - .6 GFI test and reset buttons.
 - .7 Leakage current: Class A, 5mA.
- .5 Design R5:
 - .1 Duplex receptacles with integral USB: Specification grade, CSA type 5-15R or 20A T slot as indicated, 125V, 15/20A, U-ground with the following features:

- .1 White urea moulded housing.
 - .2 Suitable for #10 AWG for back and side wiring.
 - .3 Eight (8) back wired entrances, four side wiring screws.
 - .4 Triple wipe contacts and riveted grounding contacts.
 - .5 White nylon face.
 - .6 Combination USB charger (two on each duplex receptacle).
- .6 Use the receptacles of one (1) manufacturer throughout project.

2.3 SERVICE POLES

- .1 Steel dual channel for power and communications.
- .2 Suitable for mounting of ceiling heights up to 4M high
- .3 Duplex receptacles per specifications
- .4 Provide power and data/voice opening for cables through whips where indicated on the drawings
- .5 Color: Natural aluminum finish. (Coordinate with furniture supplied service pole colors) .

2.4 COVER PLATES

- .1 Cover plates for wiring devices.
- .2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .3 Brushed stainless steel plates for wiring devices mounted in flush-mounted outlet box.
- .4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .5 Lockable UV resistant polycarbonate while-in-use weather-proof cover plates.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one (1) switch is required in one location.
 - .3 Mount toggle switches at height specified in Section 26 05 00 - Electrical General Requirements or as indicated.
 - .4 Recess switches in finished areas.

.2 Receptacles:

- .1 Install receptacles in gang type outlet box when more than one (1) receptacle is required in one location.
- .2 Mount receptacles at height specified in Section 26 05 00 - Electrical General Requirements or as indicated.
- .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .4 Mount receptacles with "U" ground up for vertically mounted and neutral slot at top for horizontally mounted receptacle.
- .5 Install "pigtail" type leads on conductors in all device or outlet boxes where feeding through to other receptacles. "Daisy-chain" or looping through of conductors from one device to another is not acceptable. Provide separate pigtail conductor leads for final termination to each receptacle for phase, neutral and bond conductors.
- .6 Use recessed receptacles in finished areas.

.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.

.4 Service Poles:

- .1 Poles to be installed from floor to ceiling.
- .2 Secure poles to the structure.
- .3 Remove all rough edges to avoid cable insulation damage when installed.

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00.
- .2 Include circuit breaker types, ratings, magnetic adjustment ranges and time-current characteristic curves for breakers with ampacity of 225 A and over. LSIG adjustment ranges to be included for LSIG breakers.

1.2 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for circuit breakers for incorporation into Manual specified in Section 01 78 00.
- .2 Include matrix for individual circuit breaker settings for all breakers with adjustable settings.

PART 2 - PRODUCTS

2.1 BREAKERS GENERAL

- .1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
- .2 Multiple pole breakers to have single handle.
- .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.
- .4 Circuit breakers with interchangeable trips as indicated.
- .5 Circuit breakers to have interrupting capacity as indicated on the Drawings.
- .6 GFI branch breakers to be ground fault interrupter type (5mA maximum) for circuits as indicated on the Drawings.
- .7 Circuit breakers for all lighting circuits must be minimum 20A, unless otherwise indicated.

2.2 THERMAL MAGNETIC BREAKERS

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 MAGNETIC BREAKERS

- .1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

2.4 SOLID STATE TRIP BREAKERS

- .1 Moulded case circuit breaker to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, long time, short time, and instantaneous tripping for phase and ground fault short circuit protection. Settings to be individually adjustable.

2.5 OPTIONAL FEATURES

- .1 Include:
 - .1 On-off locking device for 10% of branch breakers and for all breakers supplying emergency lighting battery units and fire alarm devices.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install circuit breakers as required.
- .2 Adjust circuit breaker settings to the values indicated on the manufacturer's supplied Coordination Study.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

- .1 ANSI C82.1-2011, Line Frequency Fluorescent Lamp Ballasts.
- .2 IEEE C62.41.2-2002, IEEE Recommended Practice on Characterization of Surges in Voltages in Low-Voltage (1000V and less) AC Power Circuits.
- .3 IEEE C62.45-2002, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and less) AC Power Circuits.
- .4 CAN/CSA C654-14, Fluorescent Lamp Ballast Efficacy Measurements.
- .5 NECA/ESNA 500-2006, Recommended Practice for Installing Indoor Commercial Lighting Systems (ANSI).
- .6 ANSI/IESNA RP1-2004; American National Standard Practice for Office lighting.
- .7 ASTM F1137-11, Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.
- .8 FCC CFR47; USA Federal Communications Commission Frequency Allocations and Radio Treaty Matters; General Rules and Regulations.

1.2 RELATED SECTIONS

- .1 Submittal Procedures: Section 01 33 00
- .2 Environmental and Waste Management Plans: Section 01 74 21
- .3 Closeout Submittals: Section 01 78 00

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Submit shop drawings for the following:
 - .1 Luminaire.
 - .2 Lamp or light source for each luminaire type.
 - .3 Ballast for each luminaire type.
- .3 Shop Drawings:
 - .1 Shop drawings to clearly indicate the following:
 - .1 Luminaire ID number as identified in contract documents.

- .2 Fixture specification as identified in Part 2.
 - .3 Solid State Light Sources or Lamp specification as identified in Part 2.
 - .4 Solid State Drivers or Ballast specification as identified in Part 2.
 - .5 Photometric data for each luminaire type.
 - .6 Energy data for light source and driver/ballast.
- .4 Catalogue cuts lacking sufficient detail to indicate compliance with Contract documents will not be acceptable.
- .5 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental Representative. Photometric data to include:
- .1 VCP Table, spacing criterion;
 - .2 Total input watts;
 - .3 Candlepower summary, candela distribution, zonal lumen summary;
 - .4 Luminaire efficiency, C.I.E. type, coefficient of utilization;
 - .5 Lamp type;
 - .6 Lumen ratings;and
 - .7 Summary in accordance with IES procedures.

1.4 OPERATION AND MAINTENANCE

- .1 Provide operation and maintenance data for inclusion in the manual specified in Section 01 78 00.

1.5 WASTE AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Confirm emptied containers are sealed and stored safely for disposal away from children.
- .4 Disposal of fluorescent lamps.

PART 2- PRODUCTS

2.1 DRIVERS

- .1 Dimmable as indicated on drawings.
- .2 Total THD <10%.

2.2 LUMINAIRES

- .1 Refer to luminaire schedule on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Locate and install luminaires as indicated.
- .2 Coordinate installation with all other services.
- .3 Each "lay-in" type fixture must be capable of being raised upwards and moved laterally in any direction a minimum of not less than 610mm.

3.2 WIRING

- .1 Connect luminaires to lighting circuits as indicated.
- .2 Each light fixture installed in acoustic (drop ceiling systems) ceiling to have a separate "fixture drop" installed and connected to hard wired junction box or outlet box in ceiling space.
- .3 Recessed and/or surface type light fixtures (drop ceiling systems) ceiling are not to be wired in a "daisy-chain" manner or have their power sources looped between fixtures, unless the fixtures are installed end-to-end or house an integral junction box.
- .4 A maximum of four (4) drops is permitted from any single box, regardless of box size.
- .5 AC-90 fixture drops may only be supported from T-Bar ceiling grid support wires with metal type clips, approved for this particular application. The use of tye-wraps is prohibited.
- .6 If the luminaire opening in a non-accessible ceiling is less than 150mm in diameter, provide a separate fixture drop.
- .7 Run fixture drops to an accessible junction box above an accessible ceiling or an access panel.
- .8 Fixture drops are not to exceed 5m in length.

3.3 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations, support luminaires independently of ceiling with threaded rods and metal channel or aircraft cable.

3.4 LUMINAIRE ALIGNMENT

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

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

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

1.2 OPERATION AND MAINTENANCE DATA

- .1 Submit operation and maintenance data for incorporation in the Manual specified in Section 01 78 00.

PART 2 - PRODUCTS

2.1 WARRANTY

- .1 All emergency lighting units to have a minimum ten (10) year life warranty.

2.2 BATTERY UNIT - TYPE EM-1

- .1 Supply voltage: 120VAC.
- .2 Output voltage: 12Vdc.
- .3 Operating time: four (4) hours continuous operation, based on full DC load.
- .4 Battery: sealed, maintenance free, ten (10) year life warranty.
- .5 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01 V for plus or minus 10% input variations.
- .6 Solid state transfer circuit.
- .7 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.
- .8 Signal lights: LED solid state, for 'AC Power ON' and 'High Charge'.
- .9 Lamp heads: integral on unit, 345 horizontal and 180 vertical adjustment.
- .10 Lamp type: LED Type 4W (MR-16).

- .1 Cabinet: suitable for direct mounting to wall and complete with knockouts for conduit. Removable or hinged front panel for easy access to batteries.
- .2 Finish: white.
- .3 Auxiliary equipment:
 - .1 Test switch.
 - .2 Self-diagnostic circuitry.

2.3 REMOTE HEAD TYPE EM-2

- .1 Supply voltage: 12 V dc from the battery pack as indicated on the Drawings.
- .2 Lamp heads: Lamp heads and stem shall be injection molded, impact resistant, flame retardant thermoplastic. Lamp heads shall be fully adjustable for aiming lamps. Lamp type: two (2) LED Type 4W lamps (MR-16).
- .3 Mounting: mounts directly onto standard octagon Junction box.
- .4 Housing: 125mm round canopy with two (2) lamp heads. Colour is to be white.

2.4 WIRING OF REMOTE HEADS

- .1 Conduit: As specified in Section 26 05 34 - conduits, conduit fastenings and fittings.
- .2 Conductors: minimum #12 AWG RW90 in conduit.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install unit equipment and remote mounted fixtures as indicated.
- .2 Direct heads as indicated.
- .3 Make connections.
- .4 Test and verify operation of units upon loss and restoration of normal ac power. Verify 30 min. battery life upon loss of power.

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00.
- .2 Data to include unit specifications and components, mounting method, source of power and special attachments.

1.2 OPERATION AND MAINTENANCE DATA

- .1 Submit operation and maintenance data for incorporation in the Manual specified in Section 01 78 00.

1.3 REFERENCE

- .1 CAN/CSA-C860-2011, Performance of Internally Lighted Exit Signs.

PART 2 - PRODUCTS

2.1 EXIT LIGHT TYPE EXL-1

- .1 Housing: die cast aluminum, brushed aluminum finish.
- .2 Face and back plates: die cast aluminum.
- .3 Lamps: One LED-2W panel 120VAC, 219,000 h.
- .4 Face plate: number of faces as indicated. Universal faces indicating "running man" pictogram only or "running man" pictogram with directional arrows.
- .5 Face plate pictogram to illustrate image and direction specific to application and installation eg: exist straight form here; progress down to right; progress left; etc.
- .6 Face plate to remain captive for re-lamping.
- .7 Finish: white finish.
- .8 Options: Unit complete with integral 90 minute battery backup.
- .9 Mounting: Unit to have universal mounting position and single or double face with knock out arrows as indicated.

- .10 Minimum ten (10) year life warranty.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install exit lights.
- .2 Install correct pictogram(s).
- .3 Connect fixtures to exit light circuits as indicated on the drawings.
- .4 Confirm exit light circuit breaker is locked in on position.

END OF SECTION