

PART 1 - GENERAL

<u>1.1 GENERAL</u>	.1	This Section covers items common to Section of Division 26.
<u>1.2 REFERENCES</u>	.1	CSA C22.1-18, Canadian Electrical Code.
	.2	CSA C22.3 No. 7-20, Underground Systems.
	.3	EEMAC Y1-2-1979, Performance Specification for Finishing Systems for Outdoor Electrical Equipment.
	.4	CSA C235-20, Preferred Voltage Levels for AC Systems up to 50 000V.
<u>1.3 CODES AND STANDARDS</u>	.1	Do complete installation in accordance with CSA C22.1, and local regulations.
<u>1.4 CARE, OPERATIONS AND START-UP</u>	.1	Instruct the Departmental Representative and operating personnel in the operation, care and maintenance of 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.
<u>1.5 VOLTAGE RATINGS</u>	.1	Operating voltages: to CSA 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.
<u>1.6 PERMITS, FEES AND INSPECTION</u>	.1	Submit to Electrical Inspection Department, Municipal Authority and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of Work.
	.2	Pay associated fees.

- | | | |
|--|----|--|
| | .3 | The Departmental Representative will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost. |
| | .4 | Notify the Departmental Representative of changes required by Electrical Inspection Department prior to making changes. |
| | .5 | Furnish Certificates of Acceptance from Electrical Inspection Department or other authorities having jurisdiction on completion of work to the Departmental Representative. |
| <u>1.7 MATERIALS AND EQUIPMENT</u> | .1 | Equipment and material to be CSA certified or certified by an agency recognized by the Electrical Inspection Department and authorities having jurisdiction. Where there is no alternative to supplying equipment, which is not CSA certified, obtain special approval from the authority having jurisdiction and the Departmental Representative. |
| | .2 | Factory assemble control panels and component assemblies. |
| <u>1.8 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS</u> | .1 | Control wiring and conduit is specified in Division 26, except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 25 and shown on mechanical drawings. |
| | .2 | Coordinate supplier and installer responsibility for equipment specified in other specification divisions to ensure complete and functioning systems. |
| | .3 | Confirm location of mechanical equipment with mechanical drawings. |
| <u>1.9 FINISHES</u> | .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. |
| | .4 | Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint. |
| | .5 | Clean, prime and paint exposed non-galvanized hangers, racks and fastenings to prevent rusting. |

1.10 EQUIPMENT
IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels.
- .2 Identification:
 - .1 Provide all switchboards, panels, disconnect switches, receptacles, MCC's, transformers, control panels, magnetic starters, TOL's, etc. with "lamicoid" nameplates as further described herein. Take care to affixed plates true and level, and plumb in all instances.
 - .2 Affix nameplates to all "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 (buttered) to complete rear side of plate, as opposed to several locations or areas on same.
 - .6 Lamicoid nameplates installed on distribution panelboards, motor control centres, transformers, etc. 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 EP-1
120/208V, 3PH, 4W
FED FROM PANEL DP-1

- .7 Lamicoid nameplates installed on combination starters, magnetic starters, manual starter and all various systems controls, control panels, disconnect switches, etc., to contain the following information:
 - .1 Designated name of equipment or equipment being fed, whichever is applicable.
 - .2 Designated name of power source.
 - .3 Branch circuit breaker number(s) where possible.
 - .4 Voltage(s) and phase.

EXHAUST FAN NO. 2 SUPPLY FAN NO. 1
PANEL DP-1 CCT.NO. 3 M.C.C. NO. 1
120V - 1 PH 600V - 3 PH

- .8 Lamicoid nameplates installed on fusible type disconnect switches are to also indicate the maximum designated/design fuse size.
- .9 Install lamicoid 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 lamicoid nameplates adjacent to each overcurrent device located in switchboards, CDP panels, etc. They need only indicate designated name and/or number of equipment they feed. Identify unused O.C. devices as spare(s).
- .11 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). 1.5 mm thick x 13 mm high complete with 6 mm black letters on white face, directly above all flush receptacles. Plate to be identical width as finish device plate.
- .12 Allow for an "average" of 40 letters for each lamicoid nameplate.
- .13 Lamicoid 3 mm thick plastic engraving sheet, white face, black core, for all electrical systems except fire alarm which shall have red face with white core.
- .14 Nameplates above receptacles as previously indicated, with top left and right corners to be rounded off.
- .15 Lettering on lamicoid nameplates must not "start", nor "end" nearer than 9 mm from either, or both ends of said plates. Size of lettering, including overall lengths of various plates to be as indicated in the following chart:

NAMEPLATE SIZES

Size 1	10mm x 50mm	1 line	5mm high letters
Size 2	13mm x 75mm	1 line	6mm high letters
Size 3	16mm x 75mm	2 lines	5mm high letters
Size 4	19mm x 90mm	1 line	10mm high letters
Size 5	50mm x 90mm	2 lines	10mm high letters
Size 6	25mm x 100mm	1 line	10mm high letters
Size 7	25mm x 100mm	2 lines	6mm high letters
Size 8	50mm x 150mm	3 lines	10mm high letters
Size 9	50mm x 100mm	3 lines	10mm high letters

- .16 Have wording on nameplates and labels approved by the Departmental Representative prior to manufacture.
- .17 Identification to be English.
- .18 Provide lamicoid nameplates and installed on, or adjacent to, all various systems' control panels and/or cabinets complete with information as indicated. Nameplates to reflect individual system's assigned name, and where applicable, shall also indicate both designated panel name and associated branch circuit breaker number(s).
- .3 Control Transformers:
- .1 Concealed control transformers located within ceiling spaces are to have lamicoid 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 All control transformers installed in either control cabinets or on walls adjacent to same, are to be identified with lamicoid nameplates containing information as previously indicated.

- .4 Co-ordinate names of equipment and systems with other trades to make equipment identification consistent.
- .5 In addition to required nameplates and colour coding, distribution junction boxes to have the panel and circuit numbers of all wiring contained within listed on the coverplate. List to be written using black indelible marker.
- .6 Identification of electrical distribution junction boxes, pull boxes, splitter troughs, outlet boxes:
 - .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.
- .7 Provide clearly visible marking on electrical equipment to warn persons of potential electrical shock and arc flash hazards as specified in Section 2 of the Canadian Electrical Code.
- .8 Terminal boxes, panels and miscellaneous equipment fed from two (2) or more sources to be provided with a warning nameplate prominently displayed: "CAUTION - MORE THAN ONE SOURCE VOLTAGE".
- .9 Terminal boxes, panels and miscellaneous wire ways containing intrinsically safe circuits to be provided with a warning nameplate prominently displayed: "INTRINSICALLY SAFE CIRCUIT".

1.11 WIRING IDENTIFICATION

- .1 Identify wiring with self laminating permanent indelible identifying markings, on both ends of phase conductors of feeders and branch circuit wiring. Panduit PLD-1 and PLD-2 or equivalent.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.
- .5 Indicate panel and circuit number of all phase conductors (i.e.: "Panel "A" - cct 3").
- .6 Identify all neutral conductors, bonding and ground conductors to indicate the phase conductor with which they are associated.
- .7 Indicate MCC designation and section number (i.e.: MCC #1, Section

F2B) of all phase conductors.

- .8 For control wiring, indicate source (designated name of equipment - terminal block identification) and destination (designated name of equipment - terminal block identification) (i.e.: MCC #1, Section F2B - TB5/JB1-TB4).

1.12 CONDUIT AND
CABLE COLOUR CODING

- .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 19 mm wide auxiliary colour.

<u>System</u>	<u>Primary Colour</u>	<u>Secondary Colour</u>
up to 250 volts	YELLOW	-
up to 600 volts	YELLOW	GREEN
Telephone	GREEN	-
Other Communication Systems	GREEN	BLUE
Fire Alarm	RED	-

- .4 For power cables to process equipment, indicate designated name of equipment and designated name of power source (i.e.: Fuel Pump #1 - fed from MCC #1).
- .5 For control cables, indicate source (designated name of equipment, control panel, junction box, etc.) and destination (designated name of control device, junction box, etc.).
- .6 Where more than one cable terminates at a device, add cable number (i.e.: -1, -2) to end of cable identification.
- .7 Use wire marker (black on yellow), complete with PVC carrier strip and self-locking nylon cable ties (black).

1.13 WIRING
TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.
- .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.

- | | | |
|--|-----|--|
| <u>1.14 MANUFACTURERS
AND CSA LABELS</u> | .1 | Visible and legible after equipment is installed. |
| | | |
| <u>1.15 WARNING SIGNS</u> | .1 | As specified and to meet requirements of Electrical Inspection Department and the authority having jurisdiction. |
| | .2 | Porcelain enamel or decal signs, minimum size 170 mm x 250 mm. |
| | | |
| <u>1.16 LOCATION OF
OUTLETS</u> | .1 | Do not install outlets back-to-back in wall; allow minimum of 150 mm horizontal clearance between boxes. |
| | .2 | Change location of outlets at no extra cost or credit, providing distance does not exceed 3.0 m, and information is given before installation. |
| | .3 | Locate light switches on latch side of doors. |
| | | |
| <u>1.17 MOUNTING
HEIGHTS</u> | .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 | Mounting heights for devices to conform with NBCC and Prince Edward Island Building Code regulations for Barrier Free design. |
| | .4 | Install electrical equipment at following heights unless otherwise indicated. |
| | .1 | Local switches: 1200 mm. |
| | .2 | Wall receptacles: |
| | .1 | General: 300 mm. |
| | .2 | Above top of continuous baseboard heater: 200 mm, minimum 450 mm AFF. |
| | .3 | In mechanical rooms: 1350 mm. |
| | .4 | Above top of counters and splashbacks: 150mm |
| | .5 | Outdoors: 1200 mm above finished grade. |
| | .3 | Panelboards: as required by Code or as indicated. |
| | .4 | Pushbutton control stations: 1350 mm AFF. |
| | .5 | Thermostats: 1500 mm AFF. |
| | .6 | Exit lights: 2400 mm. |
| | .7 | Emergency lighting heads: 2400 mm. |
| | .8 | Fire alarm stations: 1200 mm. |
| | .9 | Fire alarm bells: 2400 mm. |
| | .10 | Television outlets: 300 mm |

1.18 LOAD BALANCE

- .1 Measure phase current to panelboards with normal loads 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 the 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.

1.19 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 is kept to minimum.
- .4 Arrange and pay for holes through exterior walls and roof to be flashed and made weatherproof.

1.20 FIRESTOPPING

- .1 Provide complete CSA approved firestopping and smoke sealing of all cable, cabletrough or conduit penetrations through fire resistant separations in accordance with 07 84 00.

1.21 FIELD QUALITY
CONTROL

- .1 Conduct and pay for the following tests:
 - .1 Power generation and 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 Fire alarm system.
 - .6 Telecommunication systems.
 - .7 Gate operator and controls.
- .5 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

- .6 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 Provide type-written tabular report indicating test results.
- .7 Provide a written tabular report indicating the normal field measured load current for all new motors, indicating the overload heater element sizes and/or overload settings. Indicate the motor nameplate current.
- .8 Carry out tests in presence of the Departmental Representative. Provide five (5) days notice of such tests.
- .9 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .10 Submit typed test results for the Departmental Representative review and approval.
- .11 Have electrical work carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act representing manpower vocational training and qualifications. Employees registered in a provincial apprentice program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks. The activities permitted will be determined based on the level of training attained and the demonstration of ability to perform specific duties.

1.22 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Confirm circuit protective devices such as circuit breakers, motor circuit protectors, 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

- | | | |
|-----------------------|----|--------------------------------------|
| <u>1.1 REFERENCES</u> | .1 | CSA C22.2 No.65-19, Wire Connectors. |
|-----------------------|----|--------------------------------------|

PART 2 - PRODUCTS

- | | | |
|------------------------------------|----|---|
| <u>2.1 WIRE AND BOX CONNECTORS</u> | .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 | Tin-plated copper, colour-keyed, crimp type compression connectors (long barrel, two hole) with a straight, 45°, or 90° lug tongue configuration as required. |
| | .4 | Clamps or connectors for armoured cable, liquid tight, flexible conduit, as required. |
| | .5 | All wire connectors must be rated for operating voltage indicated. |

PART 3 - EXECUTION

- | | | |
|---|----|---|
| <u>3.1 WIRE AND BOX CONNECTORS INSTALLATION</u> | .1 | Make all 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 all joints required in branch wiring #8 AWG and smaller utilizing twist-on type connectors as manufactured by "Ideal" (colour coded wirenut) or "Marrettes" #31, #33 or #35 or approved equivalents. |
| | .3 | Make joints for wiring larger than #8 AWG utilizing colour keyed crimp type compression connectors (two-hole, long barrel, tin-plated copper) complete with manufacturer approved compression tools. Apply an initial layer of compound type tape followed by an additional layer of "Scotch" #33 vinyl tape. Bolt compression connectors together and torque in accordance with manufacturer's recommendation. Heat shrink can also be used. |
| | .4 | Plier tighten Marrette type connectors. |

- .5 Make wire connectors for connections to equipment not provided with lugs utilizing colour keyed, crimp type compression connectors (long barrel, two-hole, tin-plated copper, straight lug tongue) complete with manufacturer approved compression tools. Alternate lug tongue configurations (45° and 90°) will be accepted where required by application.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Wire and Box Connectors (0 - 1000V): Section 26 05 20.
- .2 Hangers and Supports for Electrical Systems: Section 26 05 29.
- .3 Conduits, Conduit Fastenings and Fittings: Section 26 05 34.

1.2 REFERENCES

- .1 CSA C22.2 No. 0.3-19, Test Methods for Electrical Wires and Cables.
- .2 CSA C22.2 No. 208-18, Fire Alarm and Signal Cable.

1.3 PRODUCT DATA

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

PART 2 - PRODUCTS

2.1 BUILDING WIRES

- .1 Conductors: stranded copper. Minimum size, #12 AWG.
- .2 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.
- .3 Colour code conductors in accordance with the Canadian Electrical Code.

2.2 TECK90 CABLE

- .1 Conductors:
 - .1 Grounding conductor: stranded copper.
 - .2 Circuit conductors: stranded copper, size as indicated.
- .2 Insulation:
 - .1 Type:
 - .1 Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.
- .3 Inner jacket: polyvinyl chloride material.
- .4 Armour: interlocking aluminum.
- .5 Overall covering: Polyvinyl chloride (PVC) heat, flame, moisture and UV resistant material, suitable for installation in temperatures down to -40°C.

- .6 Connectors:
 - .1 Non-hazardous rated areas:
 - .1 Thomas & Betts StarTeck Series Connectors, Appleton, Crouse-Hinds.
- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Connectors: standard as required, complete with anti-short rings.

2.4 ARMoured
CABLES

PART 3 - EXECUTION

3.1 GENERAL
CABLE INSTALLATION

- .1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .2 Cable Colour Coding: to Section 26 05 00 – Electrical General Requirements.
- .3 Conductor length for parallel feeders to be identical.
- .4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .5 Support cables independently of supports used for equipment of other trades; do not support from or secure cables to ductwork, piping.
- .6 Install cables in a neat and professional manner, so as to conserve headroom.
- .7 Install cables parallel and perpendicular to building lines.

3.2 INSTALLATION
OF BUILDING WIRES

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

3.3 INSTALLATION
OF TECK CABLE 0 - 1000 V

- .1 Install cables where noted on drawings.
- .2 Group cables wherever possible on channels.
- .3 Terminate cables in accordance with Section 26 05 20.
- .4 Install cables in accordance with Installation of Cables: General.
- .5 Do not secure cables to ductwork, mechanical piping and process piping.
- .6 Install cable identification on each end of cable.

3.4 INSTALLATION
OF ARMOURED
CABLES (AC-90)

- .1 Group cables wherever possible.
- .2 Terminate cables and make safe prior to ceiling grid being installed. All lighting drops to be terminated safely, with approved connectors, within an approved box, complete with cover.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Electrical General Requirements: Section 26 05 00

1.2 REFERENCES

- .1 CSA C22.2 No. 41-2017, Grounding and Bonding Equipment.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 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.
- .2 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.
- .3 Copper compression type, long barrel, two-hole type lugs unless specified otherwise.
- .4 Copper compression type connectors (cable to cable, cable to ground rod, etc.).

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system 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 and bonding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding and bonding connections to equipment provided with lugs except grounding terminations in 600V switchboards, 600V panels, to be copper, compression type, long barrel, two-hole connectors.
- .5 Soldered joints not permitted.
- .6 Install insulated bonding conductor in all conduits.
- .7 Install separate insulated bonding conductor to outdoor lighting standards.
- .8 Make grounding connections in radial configuration only, with connections terminating at single grounding point on the ground electrode(s) or street side of water pipe. Avoid loop connections.
- .9 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .10 Ground secondary service pedestals.
- .11 Secure the incoming circuit bonding conductor (wrap 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.
- .12 Twist all ground/bond wires together with a screw-on type wire connector, and then place in the rear of the outlet box.
- .13 Bond all EMT wall stubs or sleeves to ground as per CEC requirements.
- .14 Bond all conduits containing insulated ground conductor(s) at both ends.

3.2 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 the Construction Manager 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 RELATED SECTIONS

- .1 Wire and Cables 0-1000V: Section 26 05 21.

PART 2 - PRODUCT

2.1 SUPPORT CHANNELS

- .1 U shape, size 41.3 mm x 41.3 mm, 2.5 mm thick, surface mounted or suspended. Use hot dipped galvanized steel after fabrication.
- .2 Standard rolled structural steel shapes and plates or prefabricated structural systems, hot dipped galvanized.
- .3 53 mm angle hot dipped galvanized steel for conduit support.

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 stainless steel toggle bolts.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole stainless steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole stainless steel straps for conduits and cables larger than 50 mm.
 - .3 Use stainless steel straps for outdoor or damp locations.
- .6 Beam clamps (zinc plated steel) to secure conduit to exposed steel work.
- .7 Suspended support systems:
 - .1 Support individual cable or conduit runs with 12 mm diameter threaded rods and spring clips.

- .2 Support two (2) or more cables or conduits on channels supported by 12 mm diameter 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.
- .5 Install washer and nut on both the upper and underside of channel.
- .8 For surface mounting of two or more conduits, use channels spaced in accordance with the Canadian Electrical Code.
- .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 Provide 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 the Departmental Representative.
- .13 Install fastenings and supports as required for each type of equipment, cables and conduits, and in accordance with manufacturer's installation recommendations.
- .14 Support various suspended types of junction, pull and/or outlet boxes as well as conduits, with minimum size 9mm 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 is required for all type boxes sized 150 mm x 150 mm and smaller.
 - .2 Two (2) rods are required for boxes sized 200 mm x 200 mm and larger, up to and including those sized 300 mm x 300 mm.
 - .3 Minimum of four (4) rods are required for all boxes sized larger than 300 mm x 300 mm.
 - .4 Cut-off excess rod within 13 mm of channel bottom.
- .15 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 300 mm and mid point of "all" 90° bends. Maximum spacings between conduit support channels will be as dictated by smallest size conduit(s) being supported and/or secured to same.

- .16 Touch up all field cut galvanized steel supports with galvanizing paint and primer.
- .17 Support exterior conduit runs by clamps utilizing pipe runs or by 53 mm angle secured to the ground or concrete pad. Clamp conduit to angle and space supports as required by CEC based on the smallest size conduit being supported.

END OF SECTION

PART 1 - GENERAL

- | | | |
|---|----|---|
| <u>1.1 SHOP DRAWINGS
AND PRODUCT DATA</u> | .1 | Submit shop drawings and product data for cabinets in accordance with Section 01 33 00. |
|---|----|---|

PART 2 - PRODUCTS

- | | | |
|--|----|---|
| <u>2.1 SPLITTER BOX
(GENERATOR BOX
CONNECTION)</u> | .1 | Sheet metal enclosure (NEMA 4), welded corners and formed gasketed hinged cover suitable for locking in the closed position. |
| | .2 | Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated on single line diagram. |
| | .3 | Acceptable materials:
.1 ACE Type 4 Continuous Bus Gutter, Bel Products, Hoffman, Hammond. |
| | .4 | Complete with water resistant plugs for cable entries when generator cables not in use. |
| <u>2.2 JUNCTION AND
PULL BOXES</u> | .1 | Non-hazardous areas: Welded steel construction with screw-on flat covers for surface mounting. Surface or flush mounting as indicated. NEMA 1 for interior and NEMA 4 or 4X for exterior installations. |
| | .2 | Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes. |

PART 3 - EXECUTION

- | | | |
|---|----|--|
| <u>3.1 SPLITTER
INSTALLATION</u> | .1 | Install splitters and mount plumb, true and square to the building lines. |
| <u>3.2 JUNCTION AND
PULL BOXES
INSTALLATION</u> | .1 | Install pull boxes in inconspicuous but accessible locations. |
| | .2 | Only main junction and pull boxes are indicated. Install pull boxes to as not to exceed 30m of conduit run between pull boxes. |

3.3 IDENTIFICATION

.1

Provide equipment identification in accordance with Section 26 05 00.

END OF SECTION

PART 1 - GENERAL

- | | | |
|-----------------------|----|--|
| <u>1.1 REFERENCES</u> | .1 | CSA C22.1-18 Canadian Electrical Code, Part 1. |
|-----------------------|----|--|

PART 2 - PRODUCTS

- | | | |
|---|----|---|
| <u>2.1 OUTLET AND
CONDUIT BOXES
GENERAL</u> | .1 | Size boxes in accordance with CSA C22.1. |
| | .2 | 101.6 mm square or larger outlet boxes as required for special devices. |
| | .3 | Gang boxes where wiring devices are grouped. |
| | .4 | Blank cover plates for boxes without wiring devices. |
| | .5 | 347 V outlet boxes for 347 V switching devices. |
| | .6 | Combination boxes with barriers where outlets for more than one (1) system are grouped. |
| <u>2.2 SHEET STEEL
OUTLET BOXES</u> | .1 | Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 mm x 50 mm x 38 mm or as indicated. 101 mm square outlet boxes when more than one (1) conduit enters one (1) side with extension and plaster rings as required. |
| | .2 | 101 mm square or octagonal outlet boxes for lighting fixture outlets. |
| | .3 | 101 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls. |
| <u>2.2 CONDUIT BOXES</u> | .1 | Cast FS or FD ferrous alloy iron alloy (galvanized) boxes as required with factory-threaded hubs and mounting feet for surface mounting of switches, receptacle, thermostats and similar devices. Matching electrogalvanized steel type 'FS' or 'FD' metal device plates unless specifically indicated otherwise. |

2.3 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.

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 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- .5 Unless otherwise noted, install surface mounted outlet boxes.
- .6 Install type FS and FD outlet boxes for all outlets to be surface-mounted in non-hazardous areas.

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 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 |
- 1.3 RELATED SECTIONS .1 Section 26 05 29: Hangers, and Supports for Electrical Systems.
- 1.4 REFERENCES .1 Canadian Standards Association (CSA).
- .1 CSA C22.2 No. 45.1-19, Electrical Rigid Metal Conduit - Steel.
 - .2 CSA C22.2 No. 56-17, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .3 CSA C22.2 No. 83-2017, Electrical Metal Tubing.

PART 2 - PRODUCTS

- 2.1 CONDUITS .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .2 Rigid PVC conduit, fittings; couplings and connectors: to CSA C22.2 No. 211.2. Rigid PVC conduit to be FT4 rated.
- .3 Rigid galvanized steel (RGS) conduit: to CSA C22.2 No. 45.1, galvanized steel thread.

	.4	Flexible metal conduit: to CSA C22.2 No. 56, aluminum liquid-tight flexible metal.
2.2 CONDUIT FASTENINGS	.1	One (1) hole stainless steel straps to secure surface conduits 50 mm and smaller. Two (2) hole stainless steel straps for conduits larger than 50 mm.
	.2	Beam clamps to secure conduits to exposed steel work.
	.3	Channel type supports for two (2) or more conduits at 1.5m o.c.
	.4	9.5mm dia. threaded rods to support suspended channels.
	.5	U-type pipe clamp of conduit support on angle or U-channel.
2.3 CONDUIT FITTINGS	.1	Fittings: manufactured for use with conduit specified. Coating: same as conduit.
	.2	Factory fittings (LB, LL, LR, etc.) are to be used for 90° bends.
	.3	Connectors and couplings for EMT: steel set screw type.
	.4	Vertical/horizontal sealing fittings (malleable iron, galvanized, type EYS and EYD as required) rated for use in Class 1 hazardous areas, for use in hazardous rated areas.
2.4 EXPANSION FITTINGS FOR RIGID CONDUIT	.1	Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.
	.2	Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
	.3	Weatherproof expansion fittings for linear expansion at entry to a building as required.
2.5 FISH CORD	.1	Polypropylene: minimum 3 mm 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 Use EMT except where otherwise specified.
- .3 Use liquid tight flexible metal conduit for connection to motors, instruments, transformers and other vibrating equipment in non-hazardous areas, or TECK90 cable is used.
- .4 Use explosion proof connection for connection to explosion equipment.
- .5 Install conduit sealing fittings in hazardous areas. Fill with compound.
- .6 Install conduit sealing fittings in hazardous areas and at hazardous to non-hazardous area boundaries in accordance with the Canadian Electrical Code. Fill seals with manufacturer approved compound.
- .7 Provide conduit sealing fittings complete with drains as required by the Canadian Electrical Code.
- .8 Minimum conduit size for lighting and power circuits: 21mm.
- .9 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .10 Mechanically bend steel conduit over 21mm 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 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.
- .14 Dry conduits out before installing wire.
- .15 Install insulated copper bonding conductor in all conduit runs. Minimum size: #14 AWG or Table 16 of C.E.C. which ever is larger.
- .16 Install expansion fitting at exit point (above grade) of all underground services.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or surface channels.
- .5 Do not pass conduits through structural members.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.
- .7 Fasten to flutes of metal roof deck where practicable.

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00.
- .2 Include time-current characteristic curves for breakers with ampacity of 225 A and over.

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 Multi-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 5-10 times current rating.
- .4 Circuit breakers with interchangeable trips as indicated.
- .5 Circuit breakers to have interrupting capacity as indicated on the Drawings.

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.

PART 3 - EXECUTION

3.1 INSTALLATION .1 Install circuit breakers as required.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS .1 Electrical General Requirements: Section 26 05 00.

1.2 PRODUCT DATA .1 Submit shop drawings and product data in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES .1 Heavy duty, fusible and non-fusible, horsepower rated, single throw disconnect switch in CSA enclosure type as indicated (minimum CSA Enclosure Type 1).
.2 Electrical rating as indicated on the drawings.
.3 Provision for padlocking in off switch position by three (3) padlocks.
.4 Mechanically interlocked door to prevent opening when handle in ON position.
.5 Fuses: size as indicated.
.6 Fuseholders: suitable without adapters, for type and size of fuse indicated.
.7 Quick-make, quick-break action.
.8 ON-OFF switch position indication on switch enclosure cover.
.9 Viewing window to view open/close status of disconnect switch blades.

2.2 EQUIPMENT IDENTIFICATION .1 Provide equipment identification in accordance with Section 26 05 00.

PART 3 - EXECUTION

3.1 INSTALLATION .1 Install disconnect switches complete with fuses as indicated.

- .2 Install true, plumb and square to building lines.
- .3 Confirm disconnect switch has proper clearance for operation of handle.

END OF SECTION

PART 1 - GENERAL

- | | | |
|--------------------|----|--|
| <u>1.1 GENERAL</u> | .1 | This section pertains only to the electrical connection of motors. |
|--------------------|----|--|

PART 2 - PRODUCTS

- | | | |
|-------------------|----|--|
| <u>2.1 MOTORS</u> | .1 | Motors are supplied with associated mechanical, and architectural equipment. |
|-------------------|----|--|

PART 3 - EXECUTION

- | | | |
|-------------------------|----|---|
| <u>3.1 INSTALLATION</u> | .1 | Install wiring, flexible connections and bonding. |
| | .2 | Use liquid tight flexible conduit for connections to motors in non-hazardous rated areas, for connection to motors. |
| | .3 | Check rotation before coupling to driven equipment. |
| | .4 | Confirm electrical installation does not interfere with rotation, operation or maintenance of equipment. |

END OF SECTION