

PART 1 - GENERAL

<u>1.1 RELATED SECTIONS</u>	.1	Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
<u>1.2 REFERENCES</u>	.1	Canadian Standards Association (CSA International) .1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.
	.2	Electrical and Electronic Manufacturer's Association of Canada (EEMAC) .1 EEMAC 2Y-1, Light Gray Colour for Indoor Switch Gear.
	.3	Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC) .1 IEEE SP1122, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.
<u>1.3 DEFINITIONS</u>	.1	Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.
<u>1.4 DESIGN REQUIREMENTS</u>	.1	Operating voltages: to CAN3-C235.
	.2	Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. .1 Equipment to operate in extreme operating conditions established in above standard without to damage equipment.
	.3	Language operating requirements: provide identification nameplates and labels for control items in English and French.
	.4	Use one nameplate or label for each language.
	.5	Coordinate work with mechanical contractor to avoid interference.
<u>1.5 SUBMITTALS</u>	.1	Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
	.2	Shop drawings: .1 Submit shop drawings with contractor's stamp to indicate acceptance and conformance to installation requirements.

1.5 SUBMITTALS
(Cont'd)

- .2 (Cont'd)
- .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
 - .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
 - .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
 - .5 Submit shop drawings and product data electronically to Departmental Representative for review of conformance to design intent.
 - .6 If changes are required, notify Departmental Representative of these changes before they are made.
- .3 Quality Control: in accordance with Section 01 45 00 - Quality Control:
- .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of contract.
 - .5 Submit shop drawings and product data electronically to Departmental Representative for review of conformance to design intent.
 - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .4 Manufacturer's Field Reports: submit to Departmental Representative's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.6 QUALITY
ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.
- .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
 - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

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| <u>1.7 DELIVERY,
STORAGE AND
HANDLING</u> | .1 | Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract. |
| | .2 | Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Waste Management Plan. |
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| <u>1.8 SYSTEM STARTUP</u> | .1 | Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components. |
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| <u>1.9 OPERATING
INSTRUCTIONS</u> | .1 | Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel. |
| | .2 | Operating instructions to include following: |
| | .1 | Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment. |
| | .2 | Start up, proper adjustment, operating, lubrication, and shutdown procedures. |
| | .3 | Safety precautions. |
| | .4 | Procedures to be followed in event of equipment failure. |
| | .5 | Other items of instruction as recommended by manufacturer of each system or item of equipment. |

PART 2 - PRODUCTS

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| <u>2.1 MATERIALS AND
EQUIPMENT</u> | .1 | Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1.5 - SUBMITTALS. |
| | .2 | Factory assemble control panels and component assemblies. |
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| <u>2.2 WARNING SIGNS</u> | .1 | Warning Signs: in accordance with requirements of authority having jurisdiction and Departmental Representative. |
| | .2 | Decal signs, minimum size 175 x 250 mm. |
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| <u>2.3 WIRING
TERMINATIONS</u> | .1 | Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors. |

2.4 EQUIPMENT
IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
- .1 Nameplates: lamicaid 3 mm thick plastic engraving sheet, black face, white core (or to match building standard), lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
- .2 Sizes as follows:

NAMEPLATE SIZES

Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate .
- .5 Nameplates for junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with labels engraved "ASSET INVENTORY NO." as directed by Departmental Representative.
- .7 Disconnects, splitters & panels: indicate equipment power source and voltage.
- .8 Pull boxes: indicate system and voltage.

2.5 WIRING
IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, numbered on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.6 CONDUIT AND
CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green

- 2.7 FINISHES .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
- .1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1.
- .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

PART 3 - EXECUTION

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

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

- 3.3 CONDUIT AND CABLE INSTALLATION .1 Sleeves through concrete: sized for free passage of conduit and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

- 3.4 MOUNTING HEIGHTS .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

- 3.5 CO-ORDINATION OF PROTECTIVE DEVICES .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

- 3.6 FIELD QUALITY CONTROL .1 Load Balance:
- .1 Measure phase current to panelboards affected by the work with normal loads (lighting) operating at between time of acceptance; adjust branch circuit connections as required to obtain best balance of current phases for new and existing loads and record changes. phases for new and existing loads and record changes.

3.6 FIELD QUALITY CONTROL
(Cont'd)

- .1 (Cont'd)
- .2 Provide upon completion of work, load balance report as directed in PART 1 ACTION AND INFORMATIONAL SUBMITTALS: phase and neutral currents on panelboards affected by the work, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
 - .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Motors and associated control equipment including sequenced operation of systems where applicable.
- .3 Carry out tests in presence of Departmental Representative.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART1 - SUBMITTALS. 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.7 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

3.8 DEMOLITION

- .1 Unless otherwise noted, materials for removal become the contractor's property and shall be taken from site, and disposed of in accordance with all applicable codes, standards and regulations.
- .2 Disconnect and make safe all systems to be demolished including panels, feeders, branch circuits and equipment by other divisions. Coordinate with other divisions.
- .3 Maintain existing remaining circuits, systems, etc., which pass through area of construction. Provide necessary components to maintain systems. Ensure components will be concealed when construction is complete.
- .4 Reinstate immediately any remaining existing systems that are in-advertently interrupted during construction.

3.8 DEMOLITION
(Cont'd)

- .5 Remove redundant conduit and wiring back to source unless otherwise noted, and make safe.
- .6 Devices from demolition are not to be reused unless noted otherwise.
- .7 All fire alarm devices to remain in operation. Protect smoke detectors from dust exposure during construction.
- .8 Ensure fire alarm system is operational at the end of each shift.
- .9 After demolition work is complete and prior to proceeding with new work, notify the departmental representative for inspection.
- .10 Include a cost to remove and relocate twenty-four (24) junction boxes, and associated wiring and conduit due to new wall construction.

END OF SECTION

PART 1 - GENERAL

- 1.1 SECTION INCLUDES** .1 Materials and installation for wire and box connectors.
- 1.2 RELATED SECTIONS** .1 Section 26 05 21 - Wire and Cables (0-1000 V).
- 1.3 REFERENCES** .1 Canadian Standards Association (CSA International)
.1 CAN/CSA C22.2 No. 18-98 (R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
.2 CSA C22.2 No. 65-13, Wire Connectors.
.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
.1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
.3 National Electrical Manufacturers Association (NEMA)

PART 2 - PRODUCTS

- 2.1 MATERIALS** .1 Pressure type wire connectors to: CSA C22.2 No. 65, with current carrying parts of copper alloy sized to fit copper conductors as required.
.2 Clamps or connectors for armoured cable and flexible conduit as required to: CAN/CSA-C22.2 No. 18.

PART 3 - EXECUTION

- 3.1 INSTALLATION** .1 Remove insulation carefully from ends of conductors and:
.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No. 65.

END OF SECTION

PART 1 - GENERAL

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| <u>1.1 RELATED SECTIONS</u> | <ul style="list-style-type: none">.1 Section 26 05 20 - Wire and Box Connectors - 0.2 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings. |
| <u>1.2 PRODUCT DATA</u> | <ul style="list-style-type: none">.1 Submit product data in accordance with Section 01 00 10 - General Instructions. |

PART 2 - PRODUCTS

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| <u>2.1 BUILDING WIRES</u> | <ul style="list-style-type: none">.1 Conductors: stranded for 10 AWG (6 mm²) and larger. Minimum size: 12 AWG (4 mm²)..2 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90. |
| <u>2.2 ARMOURED CABLES</u> | <ul style="list-style-type: none">.1 Conductors: insulated, copper, size as indicated..2 Type: AC90..3 Armour: interlocking type fabricated from aluminum strip..4 Connectors: anti short connectors..5 AC90 (BX) may be used in removable ceilings and metal partition walls, maximum length 3 metres. |

PART 3 - EXECUTION

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| <u>3.1 INSTALLATION OF BUILDING WIRES</u> | <ul style="list-style-type: none">.1 Install wiring as follows:<ul style="list-style-type: none">.1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings..2 Install minimum #12 AWG green insulated ground wire in all conduits used for power or lighting circuit. |
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END OF SECTION

PART 1 - GENERAL

1.1 NOT USED .1 Not used.

PART 2 - PRODUCTS

2.1 SUPPORT CHANNELS .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted and suspended.

PART 3 - EXECUTION

3.1 INSTALLATION

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

.2 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.3 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.4 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.5 For surface mounting of two or more conduits use channels at 3 m on centre spacing.

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

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

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

.9 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.

3.1 INSTALLATION
(Cont'd)

- .10 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .11 Paint cut ends of threaded rods with zinc rust inhibiting paint.

END OF SECTION

PART 1 - GENERAL

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

1.2 SHOP DRAWINGS AND PRODUCT DATA .1 Submit shop drawings and product data for cabinets in accordance with Section 01 00 10 - General Instructions.

PART 2 - PRODUCTS

2.1 SPLITTERS .1 Construction: Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Terminations: Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 Spare Terminals: minimum three spare terminals on each connection or lug block sized less than 400 A.

2.2 JUNCTION AND PULL BOXES .1 Construction: welded steel enclosure.

.2 Covers flush mounted: 25 mm minimum extension all around.

PART 3 - EXECUTION

3.1 SPLITTER INSTALLATION .1 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 Only main junction and pull boxes are exceed 30 m of conduit run or three 90° indicated. Install pull boxes so as not to bends between pull boxes.

3.3 IDENTIFICATION .1 Equipment identification: to Section 26 05 00 - Common Work Results for Electrical.

3.3 IDENTIFICATION
(Cont'd)

.2 Identification labels: Size 2 indicating voltage and phase.

END OF SECTION

PART 1 - GENERAL

<u>1.1 REFERENCES</u>	.1	Canadian Standards Association (CSA International)
	.1	CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.
<u>1.2 SUBMITTALS</u>	.1	Submit samples for floor box in accordance with Section 01 33 00 - Submittal Procedures.
<u>1.3 WASTE MANAGEMENT AND DISPOSAL</u>	.1	Waste Management and Disposal:
	.1	Separate waste materials for recycling in accordance with Section 01 74 21 - Waste and Management Disposal.

PART 2 - PRODUCTS

<u>2.1 OUTLET AND CONDUIT BOXES GENERAL</u>	.1	Size boxes in accordance with CSA C22.1.
	.2	102 mm square or larger outlet boxes as required.
	.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 system are grouped.
<u>2.2 GALVANIZED STEEL OUTLET BOXES</u>	.1	One-piece electro-galvanized construction.
	.2	Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
	.3	102 mm square or octagonal outlet boxes for lighting fixture outlets.
	.4	Extension and plaster rings for flush mounting devices in finished walls.
<u>2.3 FITTINGS - GENERAL</u>	.1	Bushing and connectors with nylon insulated throats.
	.2	Knock-out fillers to prevent entry of debris.

2.3 FITTINGS - GENERAL	.3	Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
<u>(Cont'd)</u>	.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 6 mm of opening.
	.4	Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
	.5	Vacuum clean interior of outlet boxes before installation of wiring devices.
	.6	Identify systems for outlet boxes as required.

END OF SECTION

PART 1 - GENERAL**1.1 RELATED
SECTIONS**

- .1 Section 26 05 21 - Wires and Cables (0-1000 V).

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
- .1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated A Hardware, National Standard of Canada.
- .2 CSA C22.2 No. 56-13, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .3 CSA C22.2 No. 83-M1985(R2013), Electrical Metallic Tubing.

PART 2 - PRODUCTS**2.1 CONDUITS**

- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings with expanded ends.
- .2 Flexible metal conduit: to CSA C22.2 No. 56, steel liquid-tight flexible metal.

**2.2 CONDUIT
FASTENINGS**

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
- .1 Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 3 m on centre.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
- .3 Steel connectors and couplings for EMT.

2.4 FISH CORD

- .1 Polypropylene.

PART 3 - EXECUTION**3.1 MANUFACTURER'S
INSTRUCTIONS**

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

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms.
- .3 Use electrical metallic tubing (EMT) except where otherwise indicated.
- .4 Use flexible metal conduit for connection to motors in dry areas.
- .5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .6 Minimum conduit size for power circuits: 21 mm.
- .7 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .8 Mechanically bend steel conduit over 21 mm diameter.
- .9 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .10 Install fish cord in empty conduits.
- .11 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .12 Dry conduits out before installing wire.

**3.3 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 surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED
CONDUITS

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Run parallel or perpendicular to building lines.