

PART 1 - GENERAL

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| <u>1.1 SUMMARY</u> | .1 | Section Includes:
.1 General requirements that are common to NMS sections found in Division 26 - Electrical.
.2 Sustainable requirements for construction and verification. |
| | .2 | Related Sections:
.1 Division 26. |
| <u>1.2 REFERENCES</u> | .1 | Canadian Standards Association (CSA International)
.1 CSA C22.1, Canadian Electrical Code, Part 1 (Latest Edition), Safety Standard for Electrical Installations.
.2 CSA C22.3 No. 7-94 (R2005).
.3 CAN/CSA-C22.3 No. 1-01, Overhead Systems.
.4 CAN3-C235-83(R2006), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
.5 CSA Z85-1983. |
| | .2 | Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear. |
| | .3 | Health Canada / Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS). |
| | .4 | Do complete electrical installation in accordance with the above standards. |
| | .5 | Comply with all CSA Certification Standards and Electrical Bulletins in force at time of tender submission. |
| <u>1.3 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 |
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- 1.3 DESIGN REQUIREMENTS (Cont'd)
- .2 (Cont'd)
operating limits established by above standard.
- .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English.
- 1.4 SUBMITTALS
- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS in accordance with Division 01 and Division 02 requirements.
- .3 Shop drawings:
- .1 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or materials.
- .2 Where applicable, indicate wiring, single line and schematic diagrams.
- .3 Include wiring drawings or diagrams showing interconnection with work of other sections.
- .4 Each shop drawing will be stamped and signed by the Contractor before submitting, stating that he has checked the drawings against the requirements as called for in the Contract Documents and also in the case where the equipment is attached to or connects to other equipment, that has been properly coordinated with this equipment, whether supplied under Division 26 or under other Divisions.
- .5 Each shop drawing for non-catalogue items shall be prepared specifically for this project. If brochures are submitted for catalogue items, the brochures shall be marked definitively indicating the item or items to be supplied.
- .6 Work shall not be proceeded with on any of the equipment until final review of shop drawings received by the Contractor.
- .7 Note: Shop drawing review is for general compliance with Contract Documents. No responsibility is assumed by the Departmental Representative for correctness of dimensions or details. Corrections or comments, or lack
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1.4 SUBMITTALS
(Cont'd)

- .3 Shop drawings:(Cont'd)
 - .7 Note:(Cont'd)

thereof, made on the shop drawings during the Departmental Representative's review does not relieve the Contractor from compliance with the requirements of the drawings and specifications.
 - .8 If changes are required, notify Departmental Representative of these changes before they are made.
 - .4 Quality Control: in accordance with Section 01 14 10 - Scheduling and Management of Work.
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction 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. Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work. Pay associated fees. Departmental Representative will provide three (3) sets of drawings at no cost.
 - .5 Submit, upon completion of Work, load balance report as described in PART 3 - Load Balance.
 - .6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative. Pay all costs for any changes required by inspection authorities.
 - .5 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 7 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.
 - .6 Operation and Maintenance Data:
 - .1 Provide operation and maintenance data for incorporation into operation and maintenance manuals. Manuals shall be 3-ring binders and shall be supplied in quantities to Section 01 78 00 - Closeout Submittals.
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- 1.4 SUBMITTALS
(Cont'd)
- .6 Operation and Maintenance Data:(Cont'd)
- .2 Include in operations and maintenance data:
- .1 Details of design elements, construction features, component function and maintenance requirements to permit effective start-up operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
- .2 Technical data, product data, supplemented by bulletins, exploded views, technical description of items and part lists. Advertising or sales literature not acceptable.
- .3 Wiring and schematic diagrams and performance curves.
- .4 Names and addresses of local suppliers for items included in maintenance manuals.
- .5 Copy of reviewed shop drawings.
- .7 As-Built Drawings:
- .1 The Departmental Representative will provide the Contractor with three (3) extra sets of white prints on which the Contractor shall clearly mark as the job progresses all changes and deviations from that shown on Contractor drawings. On completion, forward to the Departmental Representative three (3) sets of drawings indicating all such changes and deviations.
- 1.5 QUALITY ASSURANCE
- .1 Quality Assurance: in accordance with Section 01 14 10 - Scheduling and Management of Work.
- .2 Qualifications: electrical work to be acrried out by qualified, licensed electricians or apprentices in accordance with authorities having jurisdiction.
- .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 Site Meetings:
- .1 In accordance with Section 01 14 10 - Scheduling and Management of Work.
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<u>1.5 QUALITY ASSURANCE (Cont'd)</u>	.3	Site Meetings:(Cont'd) .2 Site Meetings: as part of Manufacturer's Field Services, schedule site visits, to review Work, at stages listed. .1 Upon completion of Work.
<u>1.6 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 recycling or disposal as required.
<u>1.7 SYSTEM STARTUP</u>	.1	Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.
	.2	Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
	.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 aspects of its care and operation.
<u>1.8 WASTE MANAGEMENT AND DISPOSAL</u>	.1	Separate and recycle waste materials as required.
	.2	Remove from site and dispose of all packaging materials at appropriate recycling facilities.
	.3	Collect and separate for disposal: paper, plastic, polystyrene and corrugated cardboard packaging material for recycling.
	.4	Divert unused wiring and metal materials from landfill to metal recycling facility as approved by Departmental Representative.
	.5	Place materials defined as hazardous or toxic waste in designated containers.

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| 1.8 WASTE
MANAGEMENT AND
DISPOSAL
<u>(Cont'd)</u> | .6 | Ensure emptied containers are sealed and stored safely for disposal. |
| | .7 | Unused materials must not be disposed of into sewer system, streams, lakes, onto ground or in other locations, where it will pose health or environmental hazard. |
| | .8 | Do not dispose of preservative treated wood through incineration. Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Departmental Representative. |
| | .9 | Divert unused batteries and antifreeze to appropriate recycling facilities as approved by Departmental Representative. |
| | .10 | Dispose of fluorescent lamps and PCB ballasts in accordance with all Provincial and Federal Regulations. |

PART 2 - PRODUCTS

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| 2.1 MATERIALS AND
EQUIPMENT
<u></u> | .1 | Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements. |
| | .2 | Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from authority having jurisdiction or inspection authorities before delivery to site and submit such approval as described in PART 1 - Submittals. |
| | .3 | Factory assemble control panels and component assemblies. |
| 2.2 ELECTRIC
MOTORS, EQUIPMENT
AND CONTROLS
<u></u> | .1 | Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated on electrical drawings. |
| | .2 | Control wiring and conduit: as indicated except for conduit, wiring and connections below 50 V which are related to control |
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<u>2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS (Cont'd)</u>	.2	Control wiring and conduit:(Cont'd) systems specified in mechanical sections and as shown on mechanical drawings.
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<u>2.3 WARNING SIGNS</u>	.1	Warning Signs: in accordance with requirements of authority having jurisdiction inspection authorities and Departmental Representative and as indicated.
	.2	Decal signs, minimum size 175 x 250 mm.

<u>2.4 WIRING TERMINATIONS</u>	.1	Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.
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<u>2.5 EQUIPMENT IDENTIFICATION</u>	.1	Identify electrical equipment with nameplates as follows: .1 Nameplates: lamicoid 3 mm thick plastic engraving sheet black face, white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws. .2 Sizes as follows:
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NAMEPLATE SIZES			
Size 1	10 x 50 mm letters	1 line	3 mm high
Size 2	12 x 70 mm letters	1 line	5 mm high
Size 3	12 x 70 mm letters	2 lines	3 mm high
Size 4	20 x 90 mm letters	1 line	8 mm high
Size 5	20 x 90 mm letters	2 lines	5 mm high
Size 6	25 x 100 mm letters	1 line	12 mm high
Size 7	25 x 100 mm letters	2 lines	6 mm high

.2	Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
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2.5 EQUIPMENT
IDENTIFICATION
(Cont'd)

- .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 and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify panels, switches, distribution board feeder breakers and electrical equipment with nameplates.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.
- .10 Panelboards: indicate name, function, voltage, phase, number of wires, mains rating, etc.

2.6 WIRING
IDENTIFICATION

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

2.7 CONDUIT AND
CABLE
IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
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- 2.7 CONDUIT AND CABLE IDENTIFICATION (Cont'd)
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 1.5 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
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other	Green	Blue
Communication Systems		
Fire Alarm	Red	
Emergency	Red	Blue
Voice		
Other	Red	Yellow
Security Systems		

- 2.8 FINISHES
- .1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside and at least two coats of finish enamel.
- .2 Clean and touch-up surfaces of shop-painted equipment scratched or marred during shipment or installation to match original paint.
- .3 Clean, prime and paint exposed hangers, racks, fastening to prevent rusting.
- .4 Where conduit leaves concrete slabs-on-grade, apply two extra coats of Coro Gard or Green-Guard enamel paint 150 mm in and out of the slab.
- .5 Special finishes will be as indicated.

- 2.9 MATERIAL SPECIFIED
- .1 Where additional manufacturers are named under Articles entitled "Approved Manufacturers", the selection of a named manufacturer, in reference to a particular article, shall be the Contractor's responsibility.

2.9 MATERIAL SPECIFIED (Cont'd)	.2	Materials or products specified without the clauses "or approved equal" or "approved manufacturers" shall be supplied as specified and no proposed substitution will be considered.
	.3	Where approvals are granted for the use of other equipment any and all changes or additions required for the installation or operation of the approved equipment will be made by the Contractor at their own expense and no claims will be approved for any such changes, notwithstanding approval of shop drawings. Equipment that is accepted and installed and then does not perform as represented by original submitted data shall be replaced by the Contractor with equipment as specified at no charge to Canada.
	.4	Trade names are given as a standard of quality and configuration.
2.10 EXAMINATION OF OTHER WORK	.1	This Division requires the examination of the material and work for all other Divisions under which the work of this Section depends for proper completion. Any defect in work, levels or materials shall be reported to the Departmental Representative. The work of this Division shall not commence until such defects have been corrected. This also applied to existing work installed under other Contracts.
2.11 CUTTING, PATCHING, SLEEVES AND PLATES	.1	All drilling for hangers, rod, inserts and work of similar nature shall be done by Division 26.
	.2	Have sleeves installed in foundation walls to accommodate the work of this Division. Seal the space between the sleeve and conduit by packing with oakum and sealing with mastic to form a waterproof seal.
2.12 HANGERS AND EQUIPMENT SUPPORTS	.1	All equipment provided under the Electrical Division shall be complete with all necessary supports and hangers required for a safe and workmanlike installation and to avoid strain on conduit, etc. Auxiliary supports where

- 2.12 HANGERS AND EQUIPMENT SUPPORTS (Cont'd)
- .1 (Cont'd)
required shall be provided under this Division.
 - .2 Hammer driven hanger supports, eg. staples, nails, etc. will not be used.
 - .3 Expansion bolts, inserted after concrete has been poured are acceptable.
 - .4 Paint all hangers, eg. U-bolts, trapeze hangers, etc. BEFORE INSTALLATION.
 - .5 Wire is not an acceptable conduit support.

- 2.13 TESTING, ACCEPTANCE AND GUARANTEE
- .1 The work of this Contract shall be tested and installed and any defects in operation shall be remedied immediately. Tests required by local authorities shall be the responsibility of the Contractor. When the work is completed, it shall be tested in its entirety and shall be in good working order before the Certificate of Acceptance shall be issued.
 - .2 A written guarantee shall be supplied to Canada by the Contractor covering the prompt making good of any and all defects in material and workmanship for the period of one (1) year from the date of acceptance and the making good of any such defects shall be completely the responsibility of the Contractor.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
 - .2 Do overhead and underground systems in accordance with CSA C22.3 No.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.
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| <u>3.3 CONDUIT AND CABLE INSTALLATION</u> | .1 | Install conduit and sleeves prior to pouring of concrete.
.1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm. |
| | .2 | Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum. |
| <u>3.4 LOCATION OF OUTLETS</u> | .1 | Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings and the electrical drawings. |
| | .2 | Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes. |
| | .3 | Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation. |
| | .4 | Locate light switches on latch side of doors. |
| | .5 | Locate disconnect devices in mechanical and elevator machine rooms on latch side of door. |
| <u>3.5 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. |
| <u>3.6 CO-ORDINATION OF PROTECTIVE DEVICES</u> | .1 | Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings. |
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- 3.7 FIELD QUALITY CONTROL
- .1 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 Provide upon completion of work, load balance report as directed in PART 1 - Submittals: phase and neutral currents on panelboards, dry-core transformers and motor control centres, 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 14 10 - Scheduling and Management of Work.
- .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.
- .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 Submit all test reports to Departmental Representative for review.
- .6 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 PART 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 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
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| 3.7 FIELD QUALITY CONTROL
(Cont'd) | .7 | Verification requirements include: |
| | .1 | Materials and resources. |
| | .2 | Storage and collection of recyclables. |
| | .3 | Construction waste management. |
| | .4 | Resource reuse. |
| | .5 | Recycled content. |
| | .6 | Local/regional materials. |
| | .7 | Certified wood. |
| | .8 | Low-emitting materials. |
| 3.8 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 | Complete final cleaning of equipment and work area as acceptable to Departmental Representative. |
| | .4 | At time of final cleaning, clean lighting, reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt. |
| 3.9 DRAWINGS, CHANGES, ACCESSIBILITY | .1 | The drawings shall be considered to show the general character and scope of work and not the exact details of the installation. |
| | .2 | The installation shall be complete with all supports and accessories required for a complete operative and satisfactory installation. |
| | .3 | The location, arrangement and connection of equipment and materials as shown on the drawings represent a close approximation to the intent and requirements of the Contract. |
| | .4 | The right is reserved by the Departmental Representative to make reasonable changes required to accommodate conditions arising during the progress of the work. Such changes shall be done at no extra cost to Canada unless the location, arrangement or connection is more than 3.0 m from that shown. |

- 3.9 DRAWINGS, CHANGES, ACCESSIBILITY
(Cont'd)
- .5 Actual location of existing services shall be verified in the field where necessary before work is commenced.
- .6 Changes and modifications necessary to ensure co-ordination and to avoid interference or conflicts with other trades, or to accommodate existing conditions, shall be made at no extra cost to Canada.
- 3.10 PROTECTION
- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts "LIVE 120 VOLTS" or with appropriate voltage in English.
- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.
- 3.11 FIRE-PROOFING
- .1 Where cables or conduits pass through floors and fire rated walls, pack space between wiring and a three hour rated ULC certified fire stop material.
- 3.12 ACCESS
- .1 Provide access doors for all electrical equipment including motors, contactors, controls, electrical boxes, etc.
- .2 Doors: minimum size 0.3 m x 0.3 m except for items requiring larger door.
- .3 Doors: 2 mm prime coated steel.
- .4 Submit shop drawings for all access doors.
- .5 Doors to be approved for type of construction.
- .6 Location of access by Division 26.
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- 3.13 COMMISSIONING .1 Bidders are advised that Canada requires that a full commissioning process be undertaken.
- .2 Under this Contract, all necessary manpower, tools and labour costs incurred by this Contractor shall be included.
- .3 Generally the commissioning shall include but not be limited to:
- .1 Inspection and testing of all electrical equipment.
 - .2 Verification that electrical connections, wire sizes, over load heater sizes, etc., are proper and suited for the intended use.
 - .3 Functional testing of all equipment and systems including but not limited to:
 - .1 Controls.
 - .4 Adjustment, repair or replacement of all equipment or systems as required to meet the intent of the Specifications and Drawings.
- .4 Contractor's representatives shall be present at all tests; shall provide all necessary tools and manpower for removal of covers, etc.; shall make all necessary adjustments and repairs; and shall provide six (6) copies of a written test report. The test report shall include, at a minimum, the date and time, names of all persons present, the description of the test performed, all test results and a description of any adjustments or repairs made.
- .5 Refer to Section 26 08 00 - Commissioning of Electrical Systems for additional details.

PART 1 - GENERAL

<u>1.1 SECTION INCLUDES</u>	.1	Materials and installation for wire and box connectors.
<u>1.2 RELATED SECTIONS</u>	.1	Section 26 05 21 - Wire and Cables (0-1000V).
	.2	Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
<u>1.3 REFERENCES</u>	.1	Canadian Standards Association (CSA International) .1 CAN/CSA-C22.2 No.18-98, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware. .2 CSA C22.2 No.65-03, Wire Connectors.
	.2	Electrical and Electronic Manufacturers' Association of Canada (EEMAC) .1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
	.3	National Electrical Manufacturers Association (NEMA)
<u>1.4 WASTE MANAGEMENT AND DISPOSAL</u>	.1	Separate and recycle waste materials in accordance with Section 26 05 00 - Common Work Results - Electrical.

PART 2 - PRODUCTS

<u>2.1 MATERIALS</u>	.1	Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper or aluminum sized to fit copper or aluminum conductors as required.
	.2	Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

- 2.1 MATERIALS
(Cont'd)
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for conductors.
 - .2 Stud clamp bolts.
 - .3 Bolts for copper conductors.
 - .4 Bolts for aluminum conductors.
 - .5 Sized for conductors as indicated.
 - .4 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable 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 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
 - .2 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.
 - .3 Install fixture type connectors and tighten. Replace insulating cap.
 - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2.
 - .5 Install crimp type connectors.
 - .6 Install box connectors.

PART 1 - GENERAL

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| <u>1.1 Related Sections</u> | .1 | Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V. |
| <u>1.2 References</u> | .1 | CSA C22.2 No .0.3-01, Test Methods for Electrical Wires and Cables. |
| | .2 | CAN/CSA-C22.2 No. 131-M89(R2004), Type TECK 90 Cable. |
| <u>1.3 Product Data</u> | .1 | Submit product data in accordance with Section 01 33 00 - Submittal Procedures. |
| <u>1.4 Waste Management and Disposal</u> | .1 | Separate and recycle waste materials in accordance with Section 26 05 00 - Common Work Results - Electrical. |

PART 2 - PRODUCTS

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| <u>2.1 Building Wires</u> | .1 | Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG. |
| | .2 | Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90 and RWU90 as indicated. Provide RWU90 rated cable for underground wiring. Related to new service entrance feeders and site lighting circuits. RWU90 not required under interior floor slabs. |
| | .3 | Copper conductors: size as indicated, with thermoplastic insulation type TWH rated at 600 V, typically used for insulated ground wires. |
| | .4 | Neutral supported cable: 3 phase insulated conductors of aluminum and one neutral conductor of aluminum steel reinforced, size as indicated. Insulation: Type NSF-2 flame retardant rated 600 V. |
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PART 3 - EXECUTION

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

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| 1.1 WASTE
MANAGEMENT AND
DISPOSAL | .1 | Separate and recycle waste materials in accordance with Section 26 05 00 - Common Work Results - Electrical. |
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PART 2 - PRODUCTS

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| 2.1 SUPPORT
CHANNELS | .1 | Non-combustible, U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended. Set in channel poured concrete walls and ceilings where possible. |
| 2.2 MANUFACTURERS | .1 | Acceptable manufacturers: Unistrut Limited, Burndy Limited, Electrovert Limited, Canstrut Limited. |

PART 3 - EXECUTION

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| 3.1 INSTALLATION | .1 | Secure equipment to 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 | Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation. |
| | .5 | Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members. |
| | .6 | Fasten exposed conduit or cables to building construction or support system using straps.
.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller. |
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- 3.1 INSTALLATION .6 (Cont'd)
- (Cont'd)
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.
- .7 Suspended support systems.
- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .14 Provide required support where ceilings, etc. cannot support additional loads.
- .15 Paint all rods, angles, channels, etc. before installation.

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 - Submittal Procedures.
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<u>1.2 Waste Management and Disposal</u>	.1	Separate and recycle waste materials in accordance with Section 26 05 00 - Common Work Results - Electrical.
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PART 2 - PRODUCTS

<u>2.1 Splitters</u>	.1	Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
	.2	Main and branch lugs and Connection bars to match required size and number of incoming and outgoing conductors as indicated.
	.3	At least three spare terminals on each set of lugs in splitters less than 400 A.

<u>2.2 Junction and Pull Boxes</u>	.1	Welded steel construction with screw-on flat covers for surface mounting.
	.2	Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

<u>2.3 Cabinets</u>	.1	Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
	.2	Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm G1S fir plywood backboard for surface mounting.

PART 3 - EXECUTION

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| <u>3.1 Splitter Installation</u> | .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. |
| <u>3.2 Junction, Pull Boxes and Cabinets Installation</u> | .1 | Install pull boxes in inconspicuous but accessible locations. |
| | .2 | Mount cabinets with top not higher than 2 m above finished floor. |
| | .3 | Install terminal block as indicated in Type T cabinets. |
| | .4 | Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes. |
| <u>3.3 Identification</u> | .1 | Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical. |
| | .2 | Install size 2 identification labels indicating system name voltage and phase. |

PART 1 - GENERAL

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| <u>1.1 References</u> | .1 | CSA C22.1, Canadian Electrical Code, Part 1. |
| <u>1.2 Waste Management and Disposal</u> | .1 | Separate and recycle waste materials in accordance with Section 26 05 00 - Common Work Results - Electrical. |

PART 2 - PRODUCTS

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| <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 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. |
| <u>2.2 Fittings - General</u> | .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 35 mm and pull boxes for larger conduits. |
| | .4 | Double locknuts and insulated bushings on sheet metal boxes. |
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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.

PART 1 - GENERAL

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| <u>1.1 REFERENCES</u> | .1 | Canadian Standards Association (CSA International)
.1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
.2 CSA C22.2 No. 45, Rigid Metal Conduit.
.3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
.4 CSA C22.2 No. 83, Electrical Metallic Tubing.
.5 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.
.6 CAN/CSA C22.2 No. 227.3, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006). |
| <u>1.2 SUBMITTALS</u> | .1 | Provide submittals in accordance with Section 01 33 00 - Submittal Procedures. |
| | .2 | Product data: submit manufacturer's printed product literature, specifications and datasheets.
.1 Submit cable manufacturing data. |
| | .3 | Quality assurance submittals:
.1 Test reports: submit certified test reports.
.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.3 Instructions: submit manufacturer's installation instructions. |
| <u>1.3 WASTE MANAGEMENT AND DISPOSAL</u> | .1 | Separate waste materials for reuse and recycling. |
| | .2 | Place materials defined as hazardous or toxic waste in designated containers. |
| | .3 | Ensure emptied containers are sealed and stored safely for disposal away from children. |
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PART 2 - PRODUCTS

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| <u>2.1 CONDUITS</u> | .1 | Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings. |
| <u>2.2 CONDUIT FASTENINGS</u> | .1 | One hole steel straps to secure surface conduits 50 mm and smaller. |
| <u>2.3 CONDUIT FITTINGS</u> | .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 | Watertight connectors and couplings for EMT. |
| | .1 | Set-screws are not acceptable. |
| <u>2.4 FISH CORD</u> | .1 | Polypropylene. |

PART 3 - EXECUTION

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| <u>3.1 MANUFACTURER'S INSTRUCTIONS</u> | .1 | Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets. |
| <u>3.2 INSTALLATION</u> | .1 | Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass. |
| | .2 | Conceal conduits. |
| | .3 | Use electrical metallic tubing (EMT). |
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| <u>3.3 CONCEALED
CONDUITS</u> | .1 | Run parallel or perpendicular to building lines. |
| | .2 | Do not install horizontal runs in masonry walls. |
| | .3 | Do not install conduits in terrazzo or concrete toppings. |
|
<u>3.4 CLEANING</u> | .1 | Proceed in accordance with Section 01 74 11 - Cleaning. |
| | .2 | On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment. |

Part 1 - General

- 1.1 Description .1 Purpose:
- .1 Verify operation and functional performance of all systems and equipment installed by Division 26 for compliance with "Design Intent" as described in the "Commissioning Manual" which shall be provided by the Contractor.
 - .2 Document all tests and inspections.
 - .3 Verify application of operation and maintenance manuals, as-built (record) documents, spare parts listings, special tools listing, and other items as may be specified herein for support of above systems and equipment.
 - .4 Co-ordinate and direct training to personnel for operation and maintenance of noted systems and equipment.
- .2 General:
- .1 Furnish labour and material to accomplish complete commissioning as specified herein.
- .3 Commissioning Authority:
- .1 The Departmental Representative shall act as the "Commissioning Authority".
- .4 Costs: Include all costs for manpower, travel, accommodations, meals, incidental expenses, etc. in the base tender price. Canada shall not pay any additional costs for "Commissioning".
- 1.2 Quality Assurance .1 Provide for the complete commissioning periods, qualified tradesmen fully familiar with all electrical aspects of the project.
- 1.3 Documentation .1 Prior to the start of commissioning, assemble for the use of the commissioning team:
- .1 Complete contract documents, including plans and specifications showing authorized revisions.
 - .2 As-Built record documents.
 - .3 Reviewed shop drawings.
 - .4 Test reports.
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- 1.3 Documentation .1 (Cont'd)
(Cont'd)
- .5 Equipment start-up and certification reports.
 - .6 Records of required code authority inspections.
- 1.4 Submittals .1 Submit to the Commissioning Authority prior to Substantial Completion:
- .1 A Training Plan describing the extent of training to be provided, expected duration, personnel involved and schedule.
- 1.5 Responsibility Of Others .1 General Contractor:
- .1 Verify completeness of the building envelope and other items which effect the proper operation of the systems.
 - .2 Assure the participation and cooperation of other divisions (mechanical, etc.) required for the commissioning process.
- .2 Mechanical Sub-Contractor and Manufacturers:
- .1 Provide labour, material and equipment required within the scope of their specialty to facilitate the commissioning process.
 - .2 Perform tests and verification procedures required by the commissioning process when requested by the Commissioning Authority and directed by the Contractor.
- .3 Commissioning Authority:
- .1 Provide management direction to the commissioning team during final field verification and commissioning.
- .4 Canada:
- .1 Schedule personnel to participate in the commissioning process.
 - .2 Advise Commissioning authority regarding changes in building occupancy or usage.
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Part 2 - Products

- 2.1 Instrumentation .1 Instrumentation for commissioning shall be provided by agency performing prior tests.

Part 3 - Execution

- 3.1 Commissioning .1 Commissioning shall begin after all equipment and systems along with related equipment, systems and structure and areas are complete.

- 3.2 Pre-Commissioning Checks .1 Prior to advising Commissioning Authority that the systems are ready for final commissioning, perform and document pre-commissioning checks.
- .2 General:
- .1 Painted finishes touched up where damaged.
 - .2 Installation complete, cleaned up and temporary tags, stickers and coverings removed.
 - .3 Safety and operating control setpoints are as designed and control sequences are as specified.

PART 1 - GENERAL

<u>1.1 SECTION INCLUDES</u>	.1	Cover plates and their installation.
<u>1.2 RELATED SECTIONS</u>	.1	Section 01 33 00 - Submittal Procedures.
	.2	Section 26 05 00 - Common Work Results - Electrical.
<u>1.3 REFERENCES</u>	.1	Canadian Standards Association (CSA International).
	.2	CSA-C22.2 No.42.1-00, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
<u>1.4 SHOP DRAWINGS AND PRODUCT DATA</u>	.1	Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
<u>1.5 WASTE MANAGEMENT AND DISPOSAL</u>	.1	Separate and recycle waste materials in accordance with Section 26 05 00 - Common Work Results - Electrical.

PART 2 - PRODUCTS

<u>2.1 COVER PLATES</u>	.1	Cover plates for wiring devices to: CSA-C22.2 No.42.1.
	.2	Cover plates from one manufacturer throughout project.
	.3	Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
	.4	Stainless steel cover plates, 1 mm for wiring devices mounted in flush-mounted outlet box.

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| <u>2.1 COVER PLATES</u>
(Cont'd) | <p>.5 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes, unless otherwise noted.</p> <p>.6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.</p> <p>.7 Weatherproof spring-loaded cover plates complete with gaskets for single receptacles or switches.</p> |
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PART 3 - EXECUTION

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| <u>3.1 INSTALLATION</u> | <p>.1 Cover plates:</p> <p>.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.</p> <p>.2 Install suitable common cover plates where wiring devices are grouped.</p> <p>.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.</p> |
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PART 1 - GENERAL

<u>1.1 SECTION INCLUDES</u>	.1	Materials for moulded-case circuit breakers, circuit breakers, and ground-fault circuit-interrupters, fused circuit breakers.
<u>1.2 RELATED SECTIONS</u>	.1	Section 01 33 00 - Submittal Procedures.
	.2	Section 01 74 22 - Waste Disposal.
<u>1.3 REFERENCES</u>	.1	Canadian Standards Association (CSA International).
	.1	CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).
<u>1.4 SUBMITTALS</u>	.1	Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
<u>1.5 WASTE MANAGEMENT AND DISPOSAL</u>	.1	Separate waste materials for reuse and recycling in accordance with Section 01 74 22 - Waste Disposal.
	.2	Collect and separate for disposal all packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
	.3	Separate for reuse and recycling in accordance with Waste Management Plan.

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Upgrade ATB Preboarding Lounge	BREAKERS	Page 3
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PART 3 - EXECUTION

3.1 INSTALLATION .1 Install circuit breakers as indicated.

PART 1 - GENERAL

<u>1.1 SECTION INCLUDES</u>	.1	Materials and installation for non-fused disconnect switches.
<u>1.2 RELATED SECTIONS</u>	.1	Section 01 33 00 - Submittal Procedures.
	.2	Section 01 35 30 - Health and Safety Requirements.
	.3	Section 01 74 22 - Waste Disposal.
	.4	Section 26 05 00 - Common Work Results - Electrical.
<u>1.3 REFERENCES</u>	.1	Canadian Standards Association (CSA International).
	.1	CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.
	.2	CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.
<u>1.4 SUBMITTALS</u>	.1	Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
<u>1.5 HEALTH AND SAFETY</u>	.1	Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

PART 2 - PRODUCTS

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| <u>2.1 DISCONNECT SWITCHES</u> | .1 | Non-fusible, horsepower rated disconnect switch in CSA Enclosure as indicated, to CAN/CSA C22.2 No.4 size as indicated. |
| | .2 | Provision for padlocking in on-off switch position by three locks. |
| | .3 | Mechanically interlocked door to prevent opening when handle in ON position. |
| | .4 | Quick-make, quick-break action. |
| | .5 | ON-OFF switch position indication on switch enclosure cover. |
| <u>2.2 EQUIPMENT IDENTIFICATION</u> | .1 | Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical. |
| | .2 | Indicate name of load controlled on size 4 nameplate. |

PART 3 - EXECUTION

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| <u>3.1 INSTALLATION</u> | .1 | Install disconnect switches complete with fuses if applicable. |
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