

1.0 CODES AND STANDARDS

- .1 Complete installation in accordance with the latest edition of the Canadian Electrical Code Part I (CSA C22.1) and the Saskatchewan Supplement, as well as Municipal and Provincial Codes and Regulations and the local authorities having jurisdiction. Where this specification is at variance with applicable Codes and Standards, the more stringent shall apply.
- .2 Comply with CSA Electrical Bulletins and Certification Standards in force at time of bid submission. While not identified and specified by number in this Division, these Bulletins and Standards are to be considered as forming part of related CSA Part II Standard.
- .3 All references to Codes and Standards refer to the latest edition in force at the time of bid unless specified otherwise.
- .4 Under no circumstances shall the Codes and Standards referred to above and herein, be interpreted to allow a lower standard than specified elsewhere herein.
- .5 Complete overhead systems in accordance with CSA C22.3 No. 1 and underground systems in accordance with C22.3 No. 7 except where specified otherwise.
- .6 Abbreviations for electrical terms: to CSA Z85.
- .7 Complete all work in a neat manner performed by qualified tradesmen. All work shall be completed under the on-site direction of a journeyman electrician.

2.0 QUALIFICATIONS

- .1 Designate a foreman / superintendent holding a journeyman's certificate to assume complete responsibility for the electrical construction work. Minimum experience requirement for this position is five (5) years experience as a journeyman foreman / superintendent. Submit the name, qualifications, and experience to the electrical consultant for approval.
- .2 Furnish qualified personnel to continuously direct and monitor electrical construction work.
- .3 Attend site meetings.

3.0 PERMITS, FEES

- .1 The electrical consultant will submit to the Electrical Inspection Department and Supply Authority the necessary number of drawings and specifications for examination and approval prior to commencement of work. The electrical contractor shall pay all fees associated with this examination and approval.
- .2 Obtain and pay fees associated with all electrical inspections.

4.0 APPROVED EQUIVALENTS/ALTERNATES

- .1 The listing of a manufacturer and his respective type or catalogue number as the basis of design, is to establish the construction features, sizes, quality, and accessories of an item of equipment in addition to the characteristics specified.
- .2 Approval of equivalent products will be granted on the basis of the manufacturer, and general design only. Such approval does not relieve the electrical contractor and/or supplier from providing all necessary components and finishes as called for on the drawings or in the specifications.
- .3 Request for equals must be received in the electrical consultant's office not less than seven working days prior to subcontractor bid closing date.
- .4 A detailed line-by-line compliance comparison of any product submitted for approval, must be submitted. Exceptions and non-compliance shall be clearly identified. Requests for equals must include the following:
 - .1 A detailed bill of materials correlating each item of equipment to those specified.
 - .2 Catalogue product data sheet for each proposed item of equipment. If more than one model is shown on the data sheet, indicate exactly which model is proposed.
 - .3 Copy of the specification section with each paragraph marked to show where on the product data sheet the specification requirement is satisfied (use specification cross reference numbers on the product data sheet).

- .4 If compliance with any specification requirement cannot be substantiated by reference to published data provide a typewritten compliance statement signed by an executive officer of the manufacturer. Stating that the executive proposed products comply with all specified requirements.
- .5 A contractor quoting on materials or equipment not thus approved, does so at his own risk and will be required to install those products which are approved.
- .6 The Contractor shall make allowances in his bid for the cost of any associated changes in this division made necessary by the selection of an approved product other than that named as the basis of designs. Additional costs to this division due to the departure from equipment named shall be borne by the contractor.

5.0 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- .1 Submit shop drawings, product data and samples in accordance with the requirements of General Conditions.
- .2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material. All shop drawings shall be identified with the project name.
- .3 Where applicable, include wiring, single line and schematic diagrams.
- .4 Include wiring drawings or diagrams showing interconnection with work of other Sections.
- .5 Submit a copy of each shop drawing in electronic PDF format to the electrical consultant for review. PDF documents must be generated by manufacturer's software, or from electronically published documentation. PDF documents generated by scanning technology are not acceptable. Consultant will return shop drawing submittals via email for distribution. It is the responsibility of the Contractor to ensure adequate copies of the shop drawings are distributed to required parties, including a copy at the construction site.
- .6 If hard copies are submitted, submit three (3) copies of each shop drawing to the electrical consultant for review. Two copies will be returned to the architect who will subsequently return one copy to the Contractor (to produce required copies at his expense).
- .7 All electrical shop drawings for the project shall be submitted at one time and within 30 days of contract signing.

6.0 DRAWINGS AND SPECIFICATIONS

- .1 Examine also the architectural and structural drawings and specifications.
- .2 Drawings do not indicate all construction details. Any installation involving accurate measurements of the building shall be coordinated with construction drawings and/or actual on-site measurements.
- .3 Drawings and specifications are intended to supplement each other, and any information indicated on one and omitted on the other shall be assumed as included on both.
- .4 The electrical sub-contractor shall peruse the architectural drawings and specifications to confirm size and location of all motors, controls, and other equipment in order to determine exact electrical requirements of all mechanical equipment. Ensure that all electrical work noted on architectural drawings and specifications are included in the electrical contract bid price.
- .5 In order to provide sufficient detail and clarity, the symbols used for various electrical devices, occupy more space on the drawing, than the device actually occupies when installed. The electrical sub-contractor shall use common sense when actually placing these devices, ensuring that devices are grouped wherever possible. Do not space devices along wall to coincide with the scale location of the electrical device symbol.
- .6 Bidders finding discrepancies or omissions in the specifications or drawings, or having doubt as to the meaning or intent thereof, shall at once notify the Consultant who will, if necessary, send written instructions or explanation to all bidders. Oral interpretations made to any bidder shall not effect a modification of any provision of the bid documents.

7.0 EXAMINATION OF THE SITE

- .1 Prior to submitting bid, visit the site and thoroughly investigate the location, connection points, and details of all services and systems which, in any way, may affect or tie-in with the work covered in these specifications and accompanying drawings. No extra will be considered for work resulting from conditions that would have been evident upon thorough examination of the site.
- .2 Any discrepancies, points of doubt, or contention shall be made known to the electrical consultant in writing not later than seven (7) days prior to closing date of tender; otherwise, allow for the most expensive alternative.

8.0 VOLTAGE RATINGS

- .1 Operating Voltages: to CAN3 C235.
- .2 Motors, electrical heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
- .3 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

9.0 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with the requirements of General Conditions.
- .2 Equipment and material to be CSA certified, and manufactured to standard quoted.
- .3 Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Inspection Department.
- .4 Factory assemble control panels and component assemblies.
- .5 Uniformity of manufacturer shall be maintained for any particular item or type of equipment throughout the building.

10.0 ELECTRICAL MOTORS, EQUIPMENT AND CONTROLS

- .1 Supplier and Installer responsibility is indicated in Motor Control and Equipment Schedule on electrical drawings.
- .2 Control wiring and conduit is specified in Division 26 including conduit, wiring, and connections below 50V which are related to gate control systems.

11.0 FINISHES

- .1 Shop finish metal enclosures by removal of rust and scale, cleaning, application of rust resistant primer inside and outside, and at least two coats of finished enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1.
 - .2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.

- .2 Clean and touch up surfaces to shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean, prime, and paint exposed hangers, racks, fastenings to prevent rusting.
- .4 All electrical fittings, supports, hanger rods, pull boxes, channel fittings, conduit racks, outlet boxes, brackets, clamps, etc. shall either have a galvanized finish, or have a painted finish over corrosion resistant primer.
- .5 Where indicated herein and on drawings, provide finishes to match samples as provided by the architectural consultant.

12.0 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
 - .1 Plastic laminate engraving sheet, 3 mm thick, black face, white core, self-adhesive. Nameplates identifying emergency power system circuits shall be red face with white core.
 - .2 Nameplate sizes:

Size 1 7 X 25 mm 1 line 3 mm high lettering
Size 2 7 x 40 mm 1 line 5 mm high lettering
Size 3 12 x 70 mm 2 lines 3 mm high lettering
Size 4 20 x 90 mm 1 line 8 mm high lettering
Size 5 20 x 90 mm 2 lines 5 mm high lettering
Size 6 25 x 100 mm 1 line 12 mm high lettering
Size 7 25 x 100 mm 2 lines 6 mm high lettering
 - .3 Wording on nameplates to be approved prior to manufacture.
 - .4 Allow for average of twenty-five (25) letters per nameplate.
 - .5 Identification to be English.
 - .6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
 - .7 Nameplates for disconnects, starters, contactors and control stations shall indicate equipment being controlled, and voltage.
 - .8 Nameplates for transformers shall indicate capacity, primary, and secondary voltages.
 - .9 All nameplates shall be mechanically attached with a minimum of two chrome self tapping screws as well as the self adhesive.

13.0 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings either numbered or coloured plastic tapes, on both ends of phase conductors or feeders and branch circuit wiring.
- .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.

14.0 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, and metallic sheathed cables.
- .2 Code with 305 mm band of coloured spray paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals in accessible ceiling spaces and service spaces:

600 V	Yellow
Emergency Power	Orange
120\208V	Yellow

15.0 JUNCTION BOX IDENTIFICATION

- .1 Identify all system junction boxes with enamel spray paint on entire cover. Colour shall match those specified for conduit and cable identification.
- .2 Identify all junction boxes, containing branch circuit conductors, with neat hand lettering using black felt marker indicating panel and breaker number (i.e. "B-24). Provide corresponding identification on surface adjacent to junction box as well.

16.0 WIRING TERMINATIONS

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

17.0 MANUFACTURER'S AND CSA LABELS

- .1 Manufacturer's nameplates and CSA labels to be visible and legible after equipment is installed.

18.0 WARNING SIGNS

- .1 Provide warning signs, as specified or to meet requirements of Inspection Department.
- .2 Use decal signs, minimum 175 x 250 mm size.

19.0 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.

20.0 OWNER'S EQUIPMENT

- .1 This Contractor is responsible for electrical service connections to all Owner's equipment being supplied and installed in the building and that are shown in the contract documents. All Owner's equipment will be supplied complete with starters and disconnects as required.

21.0 WORK PROVIDED FOR OTHER DIVISIONS

- .1 Provide information as to the exact size and location of all required concrete foundations and curbs for equipment.
- .2 All conduit openings through floor, walls, and ceilings shall be sleeved 25 mm larger all around the conduit. Fill the opening with 3# density acoustic media under 50% compression and seal both ends with the appropriate caulking compound. Refer to "Firestopping" specific requirements.
- .3 Supply and installation of control wiring for all line voltage thermostats, for de-icing and heat trace cable.

22.0 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit, and sleeves, prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.
- .2 Install cables, conduits, and fittings neatly and close to building structure so furring can be kept to minimum.
- .3 Conduit shall be laid out to avoid interference with other trades, and to maintain maximum headroom. Arrange conduit to conserve space, allow maintenance, and avoid crossovers where possible.

- .4 Holes through exterior walls and roof shall be flashed and made completely weatherproof.

23.0 FIRESTOPPING

- .1 Provide firestopping in accordance with the requirements of General Conditions.
- .2 Provide fire stopping and smoke seal system materials in accordance with CAN4-S115. Materials shall be asbestos free and systems shall be capable of maintaining an effective barrier against gases, flame and smoke in compliance with CAN4-S115, not exceeding opening sizes stated and conforming to all requirements of the Standard. Fire-resistance rating of fire stopping material assembly shall meet or exceed the fire-resistance rating of the floor, wall or partition being penetrated. Acceptable manufacturers include: Fyre Shield manufactured by Tremco Ltd.,

Fyre-Sil manufactured by Tremco Ltd., Mineral Wool and FSI Silicone Sealant manufactured by FSI Engineering.

Damming and backup materials, supports and anchoring devices to manufacturer's recommendations and in strict accordance with tested assembly being installed, and as acceptable to the Authority Having Jurisdiction.

24.0 ACCESS

- .1 Provide access doors for installation in walls and ceiling to service electrical equipment. Supply to appropriate trade for installation. Doors shall be ULC labelled when installed in fire separations. Wherever finish and construction allow, access doors shall be installed flush with the finished surface. Access doors shall have 16 gauge frames, 14 gauge door panels, piano hinge, screw driver latch, and mounting channels as required for installation. Minimum size shall be 300 mm x 300 mm.

25.0 COORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays, fuses, are installed to values and settings as indicated.

26.0 EXCAVATION AND BACKFILL

- .1 Route of underground electrical and communication services shall be as indicated on drawings. Depth shall be minimum 1000 mm below grade unless otherwise noted.

- .2 Backfill shall be machine tamped in 150 mm layers to prevent future settling.
- .3 Replace existing pavement, lawn turf, concrete, etc. where damaged, or removed in connection with the installation of these underground services.
- .4 Investigate location of all existing underground services which may exist in the vicinity of the new services. This contractor shall be responsible for all damage to existing services caused during excavation and backfill.
- .5 Level the bottom of all trenches with a 75 mm (minimum) layer of sand. Underground cables shall be covered by a 75 mm (minimum) layer of sand prior to backfill.
- .6 Install 150 mm wide green or yellow 6 mil poly ribbon approximately 300 mm above buried conductors, to serve as a warning flag.

27.0 CLEANING

- .1 Complete final cleaning in accordance with the requirements of General Conditions.
- .2 Protect all equipment and material from weather and the work of other trades. Remove waste periodically. Clean all materials and equipment prior to acceptance of the Work.
- .3 At time of final cleaning, clean lighting reflectors, lenses, and other lighting surfaces that have been exposed to construction dust and dirt. The electrical installation shall be left in a clean and finished condition, to the satisfaction of the electrical consultant.

28.0 TESTS

- .1 Conduct and pay for tests of the following:
 - .1 Power distribution system including phasing, voltage, grounding, and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Motors, heaters, and associated control equipment including sequenced operation of systems where applicable. Take clip on ammeter readings on all phases of motor feeders, with motor operating under full load conditions. Submit test readings to electrical consultant.

- .2 Furnish Manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to Manufacturer's instructions.
- .3 Notify electrical consultant a minimum of 48 hours prior to test.
- .4 Provide instruments, meters, equipment, and personnel required to conduct tests during and at conclusion of project.
- .5 Submit test results for electrical consultant's review.

29.0 LOAD BALANCE

- .1 Measure phase current to panelboards and distribution centres with all possible loads operating. Adjust branch circuit connections as required to obtain best balance of current between phases and record final measurements after adjustments have been completed. Load unbalance shall not exceed fifteen percent (15%).
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Submit, on completion of work, a report listing phase and neutral currents on panelboards, dry type 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.

30.0 RECORD DRAWINGS

- .1 Submit record drawings in accordance with requirements of General Conditions.
- .2 Obtain one set of solid white prints to be used for record work as actually installed. Record on this set, all changes associated with the work, including conduit and conductor sizes, route, surface, underground, concealed, etc. and all junction boxes, pull-boxes, equipment, controllers, sensors, and devices.
- .3 Obtain one set of electrical drawing prints, and upon completion of the work, transcribe all information from the on-site record prints to the as-builts. Include all changes to the electrical contract including addenda, site instructions, change orders, and site conditions. Contractor shall provide Electrical Consultant with on-site record prints to transfer the as-built information from the as-built prints to an electronic digital format using the CAD software application used to produce the original drawings. Identify CAD electronic drawing files with "AS BUILT" status.

31.0 WARRANTY

- .1 Submit a written warranty stating that all materials and workmanship will be free from defects for a period of one (1) year from date of Substantial Performance of Work. The warranty period shall not begin until:
 - Electrical Operating and Maintenance Manuals are submitted and approved.
 - Systems Demonstration and Training is completed and Systems Demonstration certificate is submitted.
- .2 The electrical sub-contractor shall remain responsible for all electrical equipment and systems until the Electrical Operating and Maintenance Manuals are submitted and approved, and the Systems Demonstration and Training has been completed.

32.0 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into an electrical operation and maintenance manual as specified herein. The following are minimum requirements.
- .2 Include in operations and maintenance data:
 - .1 Cover page including project name, year, name of owner, electrical consultant, and electrical contractor. Cover page shall be enclosed in a clear plastic cover.
 - .2 Index.
 - .3 Electrical Contractor's Guarantee.
 - .4 List of manufacturer and supplier for all items.
 - .5 Name, address and phone number of local suppliers for items included in Maintenance Manual.
 - .6 "SYSTEMS DEMONSTRATION" certificate (refer to document included in Section 26 05 01).
 - .7 Load Balance report.
 - .8 A copy of all panelboard directories.
 - .9 8 1/2" x 11" drawing indicating Single Line Diagram for electrical distribution system.
 - .10 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.
 - .11 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items and parts lists. Advertising or sales literature not acceptable.

- .12 Operating Instructions for All Systems.
- .13 Motorized Gates Test Report and Verification Report (include in "Motorized Gates" section).
- .3 Operation and Maintenance Data shall be contained within a 76 mm thick, black, hard cloth three ring binder. Binder shall be labelled directly on the front cover as well as the spine ("ELECTRICAL OPERATION AND MAINTENANCE MANUAL - PROJECT NAME - YEAR") with gold embossed lettering. Plastic sleeves for identification will not be accepted.
- .4 The following index tabs and associated product in information shall be contained within the binder:
 - Index
 - Contractor Guarantee
 - Manufacturer and Supplier List
 - Supplier Addresses and Phone Numbers
 - Systems Demonstration Certificate
 - Panelboard Directories
 - Load Balance Report
 - Single Line Diagram
 - Distribution Equipment
 - Motorized Gates
 - Disconnect Switches
 - Panelboards and Breakers

Divider tab pages shall be laminated mylar plastic with reinforced holes. Plastic tabs with typed insertions will not be accepted.

- .5 Provide three (3) operating and maintenance manuals as well as three electronic copies (CD disk containing O & M manual contents in PDF electronic format).

33.0 MAINTENANCE MATERIALS

- .1 Provide maintenance materials in accordance with the requirements of General Conditions.

34.0 CARE, OPERATION AND START-UP

- .1 Instruct owner's maintenance and operating personnel in the operation, care, and maintenance of equipment. A minimum of four (4) hours of instruction shall be provided. Provide documentation in maintenance manual confirming that instruction has been provided including description of system, owner representatives in attendance, date, and signatures.

- .2 Arrange and pay for services of Manufacturer's factory service representative 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 aspects of its care and operation.
- .4 Complete the "SYSTEMS DEMONSTRATION" document (Refer to document in this section) and include in maintenance manual.
- .5 **The instructional training session shall be videotaped**, and one copy of the video (DVD format) shall be included with each of the maintenance manuals.

35.0 REVIEW OF WORK

- .1 When the contractor is satisfied that the work is completed, and after making his own inspection of work to verify completion, the electrical contractor shall submit a written request to the electrical consultant requesting a review of work.
- .2 Any deficiencies noted by the electrical consultant during the review of work, will be listed by the electrical consultant, and issued to the contractor.
- .3 Such deficiencies shall be corrected within three (3) weeks of the issuance of the deficiency list, or by a mutually agreed upon date. Once complete, the contractor shall submit a written request to the electrical consultant requesting a final deficiency review.
- .4 If subsequent site visits are required by the electrical consultant because the deficiencies listed were not complete, all time and expense costs incurred by the electrical consultant will be the responsibility of the electrical contractor.
- .5 During construction, the electrical contractor shall make any equipment or wiring accessible for review purposes, as requested by the electrical consultant.

36.0 DEMOLITION

- .1 Remove all redundant conduit and conductors to the source of supply. Where conduit is embedded in concrete or other inaccessible locations, it shall be abandoned.

- .2 Boxes, fittings, equipment and accessories which become redundant shall be completely removed. All such material shall become the property of the Contractor and he shall remove it from the site. Re-useable items of electrical equipment shall be re-installed where indicated on the drawings.
- .3 Remove all panelboards, and other re-useable items of electrical equipment. These items shall be turned over to the Owner.
- .4 The Contractor shall visit the site prior to submitting a bid to determine the amount of demolition work involved. No extras will be considered for work resulting from conditions that would have been evident upon thorough examination of the site.

END OF SECTION

SYSTEMS DEMONSTRATION

PROJECT: _____

DATE: _____

TIME: _____ to _____

A demonstration of electrical systems was conducted on site, to instruct owner's personnel in the operation, care, and maintenance of electrical equipment and systems.

Systems included: (indicate)

___ Motorized Gates

The following persons have witnessed this demonstration:

Owners: _____
(name) (signature)

(name) (signature)

(name) (signature)

Contractor: _____
(name) (signature)

Manufacturer's Representative:

(name) (signature)

1.0 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

- .1 Wire and Cable: Section 26 05 21.
- .2 Outlet Boxes: Section 26 05 32.

2.0 Products

2.1 MATERIALS

- .1 All fixture and branch wiring joints in junction and outlet boxes shall be made with a CSA certified pressure type connector rated at 600 volts maximum. Connector body shall consist of a cone shaped coil spring insert, insulated with a colour coded flame retardant, thermoplastic shell, which shall be knurled for easy grip.
- .2 Lugs, terminals, and screws used for termination of conductors, shall be suitable for type of conductor used.
- .3 Wire connectors to CSA C22.2 No. 65-93.
- .4 Acceptable manufacturers: Buchanan

3.0 Execution

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten as recommended by Manufacturer as specified in CSA C22.2 No. 65-93. Installation shall meet secureness tests.

END OF SECTION

1.0 General

2.0 Products

2.1 MATERIALS

- .1 Conductors: copper, sized as indicated, with 600 volt insulation rated at 90°C. The conductor shall have PVC insulation with an overall nylon jacket (T90 or THHN), or cross-linked polyethylene insulation (R90 XLPE or RW90 XLPE). Underground conductors shall be rated for such use (RWU90 XLPE).
- .2 Conductor shall be stranded for sizes #10 AWG and larger.
- .3 Conductors: to CSA C22.2 38.
- .4 Armoured cable: Copper conductors, interlocking armour fabricated galvanized steel strip.
- .5 Teck cable: copper conductors sized as indicated with 600 volt insulation rated at 90°C. Chemically cross-linked thermosetting polyethylene insulation, inner jacket of polyvinyl chloride material, interlocking aluminium armour, polyvinyl chloride overall coating (FT-4 flame test rated).

3.0 Execution

3.1 INSTALLATION - GENERAL

- .1 In conduit systems in accordance with Section 26 05 34.
- .2 #12 AWG shall be the minimum wire size used for branch circuits. All building conductors shall be sized to allow for a maximum of 2% voltage drop.
- .3 Conductor phasing for three phase electrical distribution equipment shall be made phase A, B, C, from left to right when facing equipment. The A, B, C, phasing shall be continuous from the incoming utility supply, throughout the electrical system, including panels, motor control centres, transformers, etc. and shall continue through to all the branch circuitry to the final connection of the outlet or device. Phase colour coding shall be red, black and blue for phases A, B and C respectively (X, Y, Z sequence). Continuous colour coding of insulation is required for conductors sized #2 AWG and smaller. Colour code phase taping for conductors sized #2 AWG and smaller will not be allowed.

- .4 Neutral conductors shall be white, ground conductors green, and isolated ground conductors green with yellow striped identification.
- .5 Conductors drawn into conduit shall not be pulled more than 30 metres nor more than three 90° bends without pullboxes.
- .6 Lubricant for pulling conductors shall be wax base insoluble in water and non-hardening.
- .7 Conductor length for parallel feeders shall be identical.
- .8 Identify all conductors (including neutral) with “Brady” marker to describe circuit number, wherever they are terminated in a junction box or panelboard.
- .9 Neutral conductors shall not be derated.
- .10 When changing the rotation of three phase motors, the change shall be made at the motor splice box.
- .11 Switch leg conductors shall be orange in colour (including low voltage relays).
- .12 Low voltage wiring shall be red, blue, and orange in colour, minimum #16 AWG, THHN.
- .13 Control wiring conductors shall be red in colour (except associated building neutral conductor shall be white in colour).
- .14 Ground conductors shall be green in colour **A separate insulated (green) ground conductor shall be installed in each conduit system.** The conduit system will not constitute an adequate ground.
- .15 Install a separate insulated (green) ground conductor for each motor circuit.
- .16 Insulation for all conductors installed exterior to the building shall be rated at minus 40 degrees Celsius.
- .17 Circuits sharing a neutral shall be consecutive breakers in the panel (i.e. 1, 3, 5 or 8, 10, 12).
- .18 Refer to Section 26 05 34 regarding installation of armoured cable.
- .19 Branch wiring for emergency power supply branch circuits shall be banded with yellow identification.

END OF SECTION

1.0 General

2.0 Products

2.1 MATERIALS

- .1 Grounding equipment to: CSA C22.2 No. 41.
- .2 Copper grounding conductors to: ASA G7.1.

2.2 EQUIPMENT

- .1 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 Compression connectors – Burndy Type #YGHR-C (ground rod to cable) and #YGHC-C (cable to cable).
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.
- .2 Clamps for grounding of conductor, (size as required) to electrically conductive underground water pipe.
- .3 #3/0 Copper conductor between rod electrodes, bare, stranded, un-tinned, soft annealed.
- .4 Rod electrodes, copper clad steel, 19 mm diameter by 3000 mm long. (minimum three rods spaced at 3 metres on centre)

3.0 Execution

3.1 INSTALLATION - GENERAL

- .1 Install a complete permanent continuous grounding system including electrodes, conductors, connectors, accessories, as indicated, to conform to requirements of electrical consultant and local authority having jurisdiction over installation.
- .2 Install connectors to Manufacturer's instructions.

- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp of cup washer and screw. Neatly cleat bonding wire to exterior or flexible conduit.
- .7 Install separate insulated green ground conductor in each conduit system. The conduit system will not be considered as providing an adequate ground.
- .8 Use compression connectors to attach ground conductor to ground rods.
- .9 Each motor shall be provided with a separate insulated (green) ground conductor originating at the panel or Motor Control Centre from which the motor is energized.
- .10 Provide 150 mm diameter plastic sleeve at each ground rod to facilitate inspection of connection at each ground rod. Sleeve shall extend 500 mm below grade, with top of sleeve extending 25 mm above grade. Cap each sleeve with plastic cap.
- .11 Install a separate bonding conductor to each equipment branch circuit.
- .12 Connect Gate structural steel to ground by welding copper ground conductor to steel.

3.2 GROUND ROD ELECTRODES AND GRID

- .1 Install ground rod electrodes so that top of rod is 450 mm below finished grade.
- .2 Use #3/0 AWG bare copper conductor to interconnect ground rod electrodes. Install interconnecting conductor in trench 500 mm below grade. Provide 150 mm bending radius in conductor at ground rod electrode connections. Provide and install copper conductor (minimum #3/0 AWG) to main distribution equipment.
- .3 Install 150 mm wide warning tape over ground rod electrodes and associated interconnecting conductor, 200 mm below grade.

3.3 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to the following list: Service equipment, transformers, switchgear, frames of motors, motor control centres, starters, cable trays, control panels, gate steel work, and distribution panels.

3.4 TESTS

- .1 Perform tests in accordance with Section 26 05 01.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of the Electrical Consultant and local authority having jurisdiction over installation. Ground resistance to be maximum five (5) ohms prior to connections being completed at the ground grid.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

END OF SECTION

1.0 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

- .1 Conduit, conduit fastenings, and conduit fittings: Section 26 05 34.
- .2 Fasteners, Equipment Fasteners, and Security Fasteners: Section 06 61 00

2.0 Products

2.1 SUPPORT CHANNELS

- .1 Support channels, length as indicated, U-shape, size 41 mm x 41 mm, 2.5 mm thick, surface mounted or suspended.

2.2 FASTENERS

- .1 Acceptable Fasteners:
 - Hilti "HKD"
 - Hilti "kwik" bolts
 - beam clamps

2.3 MANUFACTURERS

- .1 Acceptable Channel manufacturers: Burndy Ltd., Electrovert Ltd., Unistrut Ltd.

3.0 Execution

3.1 INSTALLATION

- .1 Lead anchors and plastic anchors will not be permitted.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Support equipment, conduit or cables using clips, spring-loaded bolts, cable clamps designed as accessories to basic channel members.
- .4 Fasten 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 Clamps to secure conduit to exposed steel work.

- .5 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.
- .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 Provide adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .8 Do not use wire lashing, tie wraps, 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 the electrical consultant.
- .10 Install fastenings and supports as required for each type of equipment cables and conduits, and to Manufacturer's installation recommendations.

END OF SECTION

1.0 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data for cabinets in accordance with Section 26 05 01.

1.2 OPERATING AND MAINTENANCE DATA

- .1 Provide data for incorporation into Electrical Maintenance Manual specified in Section 26 05 01.

2.0 Products

2.1 JUNCTION AND PULL BOXES

- .1 Junction and pull boxes: to CSA C22.2 No. 40, 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.

3.0 Execution

3.1 JUNCTION AND PULL BOXES

- .1 Install junction and pull boxes in accessible locations.
- .2 Support boxes independently of connecting conduits. Secure boxes to building structure.
- .3 Extension rings will not be allowed on junction or pullboxes.
- .4 Only main junction and pull boxes are indicated. Provide pull boxes so as not to exceed 30 meters of conduit run between pull boxes.

3.2 IDENTIFICATION

- .1 Junction and pull boxes, with size 2 identification labels indicating system name, ampacity, voltage and phase in accordance with Section 26 05 01.
- .2 Identify all 100 mm square or 100 mm octagon junction boxes, containing branch circuit conductors, with black felt marker indicating panel and breaker number (i.e. "B-24").

END OF SECTION

1.0 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

- .1 Electrical General Provisions: Section 26 05 01.

2.0 Products

2.1 SHEET METAL BOXES

- .1 All octagon boxes shall be hot dipped galvanized steel, minimum 100 mm in diameter #54151. All 100 mm square boxes shall be minimum 40 mm deep #52151. Deep boxes #52171 shall be installed where specified and where six or more conductors enter the box.
- .2 Device boxes shall be minimum 64 mm deep (#1104).

2.2 CAST BOXES

- .1 All exterior outlet boxes shall be cast aluminum with female threaded hubs suitable for surface or recessed mounting as shown and required. (Crouse Hinds FS series)

3.0 Execution

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits. Secure outlet boxes to building structure.
- .2 Fill boxes with paper to prevent entry of construction material.
- .3 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers not allowed.
- .4 Extension rings shall **not** be utilized to accommodate conductor fill requirements.
- .5 Where 25 mm conduit is utilized, outlet boxes must be minimum 119 mm (4 11/16") square.

END OF SECTION

1.0 General

1.1 RELATED WORK

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

2.0 Products

2.1 CONDUITS

- .1 Rigid metal conduit: to CSA C22.2 No. 45.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83. EMT shall be thin-walled electroplated steel.
- .3 Flexible metal conduit and liquid-tight flexible metal conduit: to CSA C22.2 No. 56.
- .4 Rigid PVC conduit: sized as indicated on drawings to CSA C22.2 No. 211.2.

2.2 CONDUIT FASTENINGS

- .1 One hole galvanized steel straps to secure surface conduits 50 mm and smaller. Use two hole galvanized 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 the following maximum spacings:

1500 mm for 13 mm and 19 mm conduits
2000 mm for 25 mm and 32 mm conduits
3000 mm for 40 mm and larger conduits

- .4 6 mm diameter threaded rods to support suspended channels.
- .5 Conduit clamps for conduits on channels.

2.3 CONDUIT FITTINGS

- .1 Fittings for raceways: to CSA C22.2 No. 18-97.
- .2 Fittings manufactured for use with conduit specified. Fittings shall be steel type.

- .3 Factory "ells" where 90 degree bends are required for 19 mm and larger conduits.

3.0 Execution

3.1 INSTALLATION

- .1 Drawings do not show all conduits. Those shown are in diagrammatic form. Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in unfinished areas and concealed ceiling spaces.
- .3 Use rigid conduit for all above ground exterior work.
- .4 Use rigid P.V.C. underground or in concrete slabs only. PVC conduit is not acceptable above floor slab.
- .5 Use flexible non-metallic tubing in concrete slabs only. Flexible non-metallic tubing is not acceptable above concrete floor slab (adapt to EMT).
- .6 Bend conduits cold, so that conduit at any point is not flattened more than 1/10th of its original diameter. Consider conduits bent more than this or kinked as defective and replace.
- .7 Mechanically bend steel conduit over 19 mm diameter.
- .8 Field threads on rigid conduit shall be sufficient length to draw conduits up tight.
- .9 Provide polypropylene pull cord in empty conduits to facilitate pulling wiring in future.
- .10 Where conduits become blocked, use of corrosive agents is prohibited. Remove and replace blocked section.
- .11 Dry conduits out thoroughly before installing wire.
- .12 Conduits shall not pass through structural members without the knowledge and consent of the structural consultant.
- .13 Locate conduits not less than 75 mm parallel to steam or hot water lines with a minimum of 25 mm at crossovers.

- .14 All conduit connectors shall be complete with a nylon insulated throat wherever conduit terminates in an outlet or junction box.
- .15 Conduit shall be secured to building structure. Do not fasten conduit to suspended ceiling or its support.
- .16 Run conduit parallel or perpendicular to building lines, when installed exposed or in ceiling spaces.
- .17 Locate conduits a minimum of 1.5 metres from infrared or gas fired heaters.
- .18 Conduits to be run in flanged portion of structural steel.
- .19 Group conduits wherever possible on surface channels.
- .20 Install CSA approved expansion fittings complete with grounding jumpers where conduits cross building expansion joints. Provide offsets in conduit adjacent to building expansion joints, where conduit is installed above suspended ceilings.
- .21 Conduits installed between heated and unheated spaces shall be sealed internally with a silicone sealant at the wall between the two spaces.

3.2 CONCEALED CONDUITS

- .1 Horizontal runs are not permitted in masonry walls.
- .2 Conduits are not permitted in terrazzo or concrete toppings.

3.3 CONDUITS IN POURED CONCRETE

- .1 Locate to suit reinforcing steel. Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Provide sleeves in advance of concrete pour where conduits pass through slab or walls.
- .4 Do not use EMT conduit in concrete slabs in contact with the earth.
- .5 Where conduits pass through waterproof membrane provide oversize sleeve before membrane is installed. Use cold mastic between sleeve and conduit.
- .6 Conduits to be completely encased in concrete.

3.4 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Thoroughly waterproof joints (PVC excepted) with a heavy coat of bituminous paint.

3.5 IDENTIFICATION

- .1 Refer to General Provisions - Conduit and Cable Identification: Section 26 05 01.

END OF SECTION

1.0 General

1.1 WORK INCLUDED

- .1 General inspection of all electrical equipment.
- .2 Specific equipment testing as specified herein or in other sections of the specifications.
- .3 Power Distribution System testing including insulation resistance testing, load balance, and voltage testing.
- .4 Building Systems testing.
- .5 Submittal of test reports.
- .6 Instruction for the Owner's staff in the cleaning, maintenance and operation of the building systems, equipment, and finishes.

2.0 Products

- .1 Provide all instruments, meters, and equipment required to conduct tests during and at the conclusion of the project.

3.0 Execution

3.1 GENERAL EQUIPMENT INSPECTION

- .1 Visually inspect all equipment delivered to the site, to identify damage due to transportation, handling, or placing into position. Verify the content of the equipment with the bill of material and note any missing items. Document all defects or damage noted and submit to the Electrical Consultant.
- .2 Ensure that the equipment is clean and free of debris before proceeding with testing or energization of the equipment.
- .3 Verify the phasing connections of the incoming and / or outgoing connections to the equipment.
- .4 Ensure that ground connections are provided to C.E.C. requirements and as specified.

3.2 TEST REPORTING

- .1 Submit general equipment inspection report to confirm that equipment has been tested and noting any damage or defects.
- .2 Submit distribution system electrical test reports including:
 - insulation resistance test results for all feeders and equipment except for 120/208 volt branch circuit wiring.
 - power distribution system voltage readings
 - load balance readings.

3.3 MOTORIZED GATES

- .1 Assist with the manufacturer's representative with the verification and testing of the motorized gates installed in this contract.

END OF SECTION

1.0 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 26 05 01.
- .2 Shop drawings shall include type, insulation, BIL, sound level, impedance, KVA rating, and enclosure dimensions.

1.2 OPERATION AND MAINTENANCE DATA

- .1 Provide data for incorporation in Electrical Maintenance Manual specified in Section 26 05 01.

2.0 Products

2.1 TRANSFORMERS

- .1 Dry type transformers: to CSA 22.2 No. 47, and CAN/CSA C802.2-00.
- .2 Use transformers of one manufacturer throughout project.
- .3 Design 1.
 - .1 Type: ANN.
 - .2 Insulation: Class H, 150 degrees Celsius temperature rise.
 - .3 Basic Impulse Level (BIL): 10kV.
 - .4 Hipot: standard.
 - .5 Average sound level: 45dB up to 45kVA, 50dB from 75kVA to 150kVA, and 55dB from 150kVA to 300kVA measured in any third octave band between 60 Hz and 1000 Hz.
 - .6 Impedance at 170 degrees Celsius: six percent maximum.
 - .7 Enclosure: EEMAC 1, removable metal front panel.
 - .8 Mounting: floor.
 - .9 Finish: ASA 61 grey.
 - .10 Windings: copper
 - .11 Taps: 2.5% of full capacity.
 - .12 Anti-vibration pads between core and the enclosure.
- .4 Transformers located in areas where fire protection sprinklers are located must be complete with a non-combustible hood or shield to prevent spray from fire protection sprinklers from entering the transformer.

2.2 MANUFACTURERS

- .1 Acceptable manufacturers: Hammond, Polygon, Square D, Rex Manufacturing, Delta, Eaton Cutler-Hammer, GE Industrial Systems, or approved equivalent.

3.0 Execution

3.1 MOUNTING

- .1 Mount floor mounted dry type transformers on 100 mm concrete housekeeping pad.
- .2 Ensure adequate clearance around transformer for ventilation.
- .3 Install transformers in level upright position.
- .4 Remove shipping supports only after transformer is installed and just before putting into service.
- .5 Loosen isolation pad bolts until no compression is visible.
- .6 Use flexible conduit to make connections to transformer.

3.2 CONNECTIONS

- .1 Make primary and secondary connections shown on wiring diagram.
- .2 Energize transformers immediately after installation is completed, where practicable.
- .3 Adjust primary taps as necessary to produce rated secondary voltage at no-load.

3.3 NOISE / VIBRATION ISOLATION

- .1 Isolate transformer noise and vibration from occupied areas of the building. Provide neoprene isolation for support of the transformer, and utilize flexible wiring connections. Advise other trades not to locate services in the area adjacent to the transformer, that may hinder the isolation of the transformer noise and vibration.
- .2 Utilize Vibro-Acoustics type NSN resilient elements below transformers.

3.4 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01.
- .2 Nameplate for each transformer Size 7 engraved in accordance with Section 16010. Indicate transformer designation, capacity, primary and secondary voltages, phase, and name of load the transformer energizes (i.e., "T-2, 300 kVA, 600/120/208V, three phase, feeds Sub-Distribution SD-1"). Mount on front face of transformer.

END OF SECTION

1.0 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 26 05 01.
- .2 Shop drawing information to include voltage, ampacity, interrupting capacity, enclosure dimensions, branch breaker types, quantity, and amperage.

1.2 OPERATION AND MAINTENANCE DATA

- .1 Provide data for incorporation into Electrical Maintenance Manual specified in Section 26 05 01.

1.3 PLANT ASSEMBLY

- .1 Install circuit breakers in panelboards before shipment.
- .2 In addition to CSA requirements, Manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

1.4 RELATED WORK SPECIFIED ELSEWHERE

- .1 Moulded Case Circuit Breakers - Section 26 28 21.

2.0 Products

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No. 29.
- .2 Panelboards to be product of one manufacturer, throughout project.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Panelboards to be complete with hinged lockable door. Two keys for each panelboard and key panelboards alike.
- .6 Tin plated aluminium bus with full size neutral.

- .7 Mains suitable for bolt-on breakers.
- .8 Finish trim and door baked grey enamel.
- .9 Panelboards shall be complete with a factory mounted grounding bus with one terminal per circuit.
- .10 Plastic sleeve for circuit breaker directory secured to inside door of panelboard.
- .11 Include drip hood on panel boards when surface mounted in a room containing fire protection sprinklers.

2.2 BREAKERS

- .1 Breakers to Section 26 28 21.
- .2 Breakers with thermal magnetic-tripping in panelboards except as indicated otherwise.
- .3 Breakers less than 19mm wide will not be permitted.
- .4 All branch breakers shall be bolt-on type.
- .5 Branch breakers in panelboards shall be rated at not less than 10,000 amps symmetrical interrupting capacity at 240 volts.
- .6 Two and three pole breakers shall have one common simultaneous trip.

2.3 MANUFACTURERS

- .1 Acceptable manufacturers: Schneider Canada, Siemens Canada Ltd., Eaton Cutler Hammer Canada, General Electric Industrial Systems, or approved equivalent.

3.0 Execution

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards (painted white). Where practical, group panelboards on common backboard.
- .3 Mount panelboards 1800 mm to top of panel.

- .4 Connect loads to circuits as indicated.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified. Circuits sharing a neutral shall be consecutive breakers in the panel (i.e. 1, 3, 5 or 12, 14,16).
- .6 Thoroughly vacuum all panelboards to remove construction debris and dust, prior to installation of panel covers.

3.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01.
- .2 Nameplate for each panelboard size 5 engraved in accordance with Section 26 05 01. Indicate panel designation, voltage, and phase (i.e. "PANEL 2E" 120/208V 3PH 4W). Mount on exterior face of panelboard cover.
- .3 Complete circuit breaker directory with typewritten legend showing location and load of each circuit breaker. Circuit breaker directory shall include all breakers in the panelboard listed on one single face typewritten legend.
- .4 Identify all spare breakers on breaker directory as "SPARE" (in pencil).

END OF SECTION

1.0 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with 26 05 01.

1.2 OPERATING AND MAINTENANCE DATA

- .1 Provide data for incorporation into Electrical Maintenance Manual specified in Section 26 05 01.

2.0 Products

2.1 HEATING CABLE

- .1 120V two conductor copper and HDPE jacketed copper sheathed mineral insulated heating cable suitable for installation as noted on drawings, rated at minimum 30w/ft. Heating cable shall include a heated section joined to a pre-terminated non-heating cold lead suitable for junction box connection and be temperature rated for 90°C. Cable shall come with all required power and end kits, de-icing controller, de-icing sensor, and all required accessories.

2.2 DE-ICING CONTROLLER

- .1 120V snow melting and de-icing, controller shall be compatible with all associated heating cables and de-icing sensors. Controller shall automatically control heating cables, come with hold-on timer for up to 10 hours, come with calibrated high limit thermostat to prevent excessive cable temperatures, provide a relay closure interface, sensor, and communications wiring shall be NEC Class 2, interface up to six sensors, be housed in a polycarbonate NEMA 3R enclosure with lockable cover, and operate between -40°C and 71°C.

2.3 DE-ICING SENSOR

- .1 120V snow and ice melting sensor suitable for detecting moisture and temperature for surface snow melting and de-icing pavement applications. Sensor shall detect precipitation as snow below 3.3°C and signal control panel. Sensors shall be at solid state design, rugged housing, epoxy potting, rated for NEC Class 2, be complete with hold on timer for continued operation an hour after snow stops, come with adjustable mounting system, and be field replaceable without disturbing the pavement.

3.0 Execution

3.1 INSTALLATION

.1 Heating Cable

- .1 Install heating cable where indicated on drawings per manufacturer's instructions/recommendations, so gate truck is kept clear of ice and snow.

.2 De-icing controller

- .1 Install controller on wall in control room coordinated with owner. Install as per manufacturer's instructions.

.3 De-icing sensor:

- .1 Install sensor in pavement, outside of vehicle pathways, as per manufacturer's instructions.

END OF SECTION

1.0 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 26 05 01.
- .2 Include time-current characteristic curves for breakers with ampacity of 400 and over.

1.2 OPERATION AND MAINTENANCE DATA

- .1 Provide data for incorporation into Electrical Maintenance Manual specified in Section 26 05 01.

2.0 Products

2.1 BREAKERS - GENERAL

- .1 Moulded case circuit breakers: to CSA C22.2 No. 5.1
- .2 Bolt-on moulded case circuit breaker, quick-make, quick break type, for manual and automatic operation.
- .3 Common-trip breakers with single handle for multi pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when the value of current reaches setting. Trip settings on breakers with adjustable trips to range 3 - 10 times current rating.
- .5 Breakers shall trip to "centre" position.

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 under overload conditions and instantaneous magnetic tripping for short circuit protection.

2.3 MANUFACTURERS

- .1 Acceptable Manufacturers: Eaton Cutler Hammer Canada Ltd. To match existing on site.

3.0 Execution

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.

END OF SECTION