

- 1 GENERAL .1 This Section covers items common to Sections of Division 26. This section supplements requirements of Section 01 33 00.
- 2 SCOPE OF WORK .1 Supply and installation of new lighting standards and associated new area lighting fixtures.
- .2 Installation of new conductors for control and power wiring from the existing buried cabling to the new pole bases, fixtures, and controls.
- .3 Provision of new grounding at each base to the new fixtures and lighting standards.
- .4 Supply and installation of new power distribution and lighting control cabinet.
- .5 Supply and installation of two (2) new mini power centers and parking lot power pedestals.
- 3 REFERENCES .1 CSA-C22.1-2012, Canadian Electrical Code, Part I.
- .2 CAN/CSA-C22.3 No. 1-2010, Overhead Systems.
- .3 CSA-C22.3 No. 7-2010, Underground Systems.
- .4 CAN3-C235-83(R2010), Preferred Voltage Levels for AC Systems, 0 to 50 000 V.
- 4 CODES AND STANDARDS .1 Do complete installation in accordance with CSA C22.1, and local regulations, except where specified otherwise.
- .2 Do underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.
- 5 COORDINATION OF OUTAGES .1 Coordinate and meet the requirements of Departmental Representative. Confirm availability of power when required.
- .2 Coordinated outages with Departmental Representative providing a minimum advance notice of two (2) weeks.
- .3 Perform Work outside of normal working hours if required.
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| <u>6 CARE, OPERATION<br/>AND START-UP</u> | .1 | Instruct Departmental Representative and operating personnel in the operation, care and maintenance of equipment.   |
|   | .2 | Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.   |
|   | .3 | Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.   |
| <u>7 VOLTAGE RATINGS</u>                  | .1 | Operating voltages: to CAN3-C235.   |
|   | .2 | Control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.   |
| <u>8 PERMITS, FEES<br/>AND INSPECTION</u> | .1 | 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. Submit this information within ten (10) working days of the award of Tender and provide the Departmental Representative with written notice at the time this has been submitted. |
|   | .2 | Provide the Departmental Representative with a copy of the Electrical Inspection Department and Supply Authority Plans Review Report immediately upon receipt. No shop drawings will be reviewed prior to receipt of the Plans Review Report from the Contractor.   |
|   | .3 | Obtain all necessary permits including an Electrical Wiring Permit for electrical Work from the authority having jurisdiction prior to commencement of Work. Provide a copy of each permit to the Departmental Representative upon receipt. The permits are to be properly displayed on the work site.  |
|   | .4 | Upon specific request, the Departmental Representative will provide to the Contractor electronic copies of the drawings and specifications required for submittal to the Electrical Inspection  |
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| 8 PERMITS, FEES<br>AND INSPECTION<br>(Cont'd) | .4 | (Cont'd)<br>Department and Supply Authority. These drawings and specifications will be provided to the Contractor at no cost, unless specified otherwise.   |
|   | .5 | Arrange for all required inspections to be conducted by the authority having jurisdiction. Provide a copy of all inspection reports to the Departmental Representative immediately upon receipt. Notify the Departmental Representative immediately of changes required by the authority having jurisdiction.                                 |
|   | .6 | Furnish Certificates of Acceptance from authorities having jurisdiction upon completion of work. Include a copy in the Operation and Maintenance Manual.  |
|   | .7 | Pay all associated fees.  |
| 9 MATERIALS AND<br>EQUIPMENT                  | .1 | Provide materials and equipment for Departmental Representative's review.   |
|   | .2 | Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the authority having jurisdiction.  |
|   | .3 | Factory assemble control panels and component assemblies.   |
| 10 FINISHES                                   | .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.  |
| 11 EQUIPMENT<br>IDENTIFICATION                | .1 | Identify electrical equipment with nameplates and labels as follows:  |
|   | .2 | Identification:<br>.1 All disconnect switches, splitters, transformers, control panels, junction boxes, pull boxes, etc. are to be provided with "lamicoid" nameplates as further described herein. Affix nameplates true and level, and plumb in all instances.<br>.2 Affix nameplates to all "metal" surfaces with steel type "pop-rivets". |
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11 EQUIPMENT  
IDENTIFICATION  
(Cont'd)

- .2 Identification:(Cont'd)
- .3 Affix nameplates to other types of surfaces with contact type cement.
- .4 Apply contact type cement to complete rear side of plate, as opposed to several locations or areas on same.
- .5 Lamicoid nameplates installed on equipment, etc. to indicate the following:
- .1 Designated name of equipment.
- .2 Amperage of overcurrent protection device.
- .3 Voltages, number of phases and wires.
- .4 Designation of power source.

Example:

PANEL H - 150 AMPS  
120/208V - 3PH - 4W  
FED FROM MAIN SWITCHBOARD

- .6 Allow for an "average" of 40 letters for each lamicoid nameplate.
- .1 Lamicoid 3 mm thick plastic engraving sheet, black face, white core, for all electrical systems except fire alarm and emergency power systems which shall have red face with white core.
- .2 Lettering on lamicoid nameplates shall not "start", nor "end" nearer than 9 mm from either, or both ends of said plates. Size of lettering, including overall lengths of various plates shall be as indicated in the following chart.

NAMEPLATE SIZES

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

- .3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.
- .4 Identification to be English.
- .5 Co-ordinate names of equipment and systems with other trades to achieve equipment identification consistency.

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| <u>11 EQUIPMENT IDENTIFICATION (Cont'd)</u> | .6 | Identify main power distribution boxes with the tower number in 150mm high letters on 1.2mm-thick laser etched 316 stainless steel labels.   |
| <u>12 WIRING IDENTIFICATION</u>             | .1 | Identify wiring with self laminating permanent indelible identifying markings on both ends of phase conductors of feeders and branch circuit wiring and in all junction and/or pull boxes located in between. Labels to be installed in a "flagged" manner. Panduit PLD-1 and PLD-2 or equivalent. |
|   | .2 | Maintain phase sequence and colour coding throughout.  |
|   | .3 | Colour code: to CSA C22.1.   |
|   | .4 | Indicate panel and circuit number of all phase conductors i.e.: "Panel "A" - cct 76mm. Identify all neutral conductors bonding and ground conductors to indicate the phase conductor with which they are associated.   |
| <u>13 WIRING TERMINATIONS</u>               | .1 | Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.  |
|   | .2 | Label all branch circuit wiring including phase conductors, neutral, ground and/or bonding conductors to be done on both ends of all circuit wires plus in any junction and pull boxes located between ends. Use write-on self laminating labels. Wrap around conductor in a "U" fashion.          |
| <u>14 MANUFACTURERS AND CSA LABELS</u>      | .1 | Visible and legible after equipment is installed.  |
| <u>15 WARNING SIGNS</u>                     | .1 | As specified and to meet requirements of Electrical Inspection Department and Departmental Representative.   |
|   | .2 | Porcelain enamel decal signs, minimum size 170mm x 250mm.  |
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- 16 LOAD BALANCE
- .1 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
  - .2 Submit, at completion of Work, report listing phase and neutral currents on lighting circuits under normal load. State hour and date on which each load was measured, and voltage at time of test.
- 17 FIELD QUALITY CONTROL
- .1 Conduct and pay for following tests:
    - .1 Power distribution system including phasing, voltage, grounding and load balancing.
    - .2 Circuits originating from branch distribution panels.
  - .2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
  - .3 Insulation resistance testing.
    - .1 Megger existing and new circuits, feeders and equipment up to 350 V with a 500 V instrument.
    - .2 Check resistance to ground before energizing.
  - .4 Carry out tests to satisfaction of Departmental Representative.
  - .5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- 18 QUALITY ASSURANCE
- .1 Instructions:
    - .1 Electrical workmanship: provide workmanship of the highest quality. Sub-standard work will not be accepted. Use only persons skilled in the trades involved.
    - .2 Electrical materials: provide all materials used in this work, unless particularly specified otherwise, that are new, free from flaws, or imperfections.
    - .3 Sleeves and inserts: furnish and locate all sleeves and inserts required for this work in accordance with drawings.
  - .2 Applicable standards:
    - .1 All electrical Work must conform with the requirements and recommendations of the latest edition of the Canadian Electrical Code and all local
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| 18 QUALITY<br>ASSURANCE<br>(Cont'd) | .2 | Applicable standards:(Cont'd) |
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- .1 (Cont'd)
  - codes and ordinances. In conflicts between codes, the more stringent requirements shall govern.
  - .2 In no instance will the standard established by this specification be reduced by any of the codes or standards referred to in this specification.
  - .3 Standards: the specifications and standards of the following organizations are by reference made as part of these specifications and all electrical Work, unless otherwise indicated, will comply with their requirements and recommendations wherever applicable.
  - .4 Canadian Standard Association (CSA).
  - .5 Illuminating Consultants Society (I.E.S.).
  - .6 Institute of Electrical Electronic Consultants (I.E.E.E.).
  - .7 American Society for Testing Materials (A.S.T.M.).
  - .8 Certified Ballast Manufacturers (C.B.M.).
  - .9 Insulated Power Cable Consultants Association (I.P.C.E.A.).
  - .10 Electrical Equipment Manufacturer's Association of Canada (E.E.M.A.C.).
  - .11 National Fire Protection Association (N.F.P.A.).
  - .12 Underwriter's Laboratories of Canada (U.L.C.).
  - .13 Joint Industrial Council (J.I.C.).
  - .14 All local and provincial codes and ordinances.

## PART 1 - GENERAL

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| <u>1.1 REFERENCES</u> | .1 | EEMAC 1Y-2-1979, Performance Specification for Finishing Systems for Outdoor Electrical Equipment. |
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## PART 2 - PRODUCTS

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| <u>2.1 WIRE AND BOX CONNECTORS</u> | .1 | Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.   |
|                                    | .2 | Fixture type splicing connectors: with current carrying parts of copper sized to fit copper conductors 10 AWG or less.   |
|                                    | .3 | Bushing stud connectors: to EEMAC 1Y-2 to consist of:<br>.1 Connector body and stud clamp for copper conductors.<br>.2 Bolts for copper conductors.<br>.3 Sized for conductors as noted. |
|                                    | .4 | Clamps or connectors for armoured cable, liquid tight, flexible conduit, as required.  |

## PART 3 - EXECUTION

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| <u>3.1 WIRE AND BOX CONNECTORS INSTALLATION</u> | .1 | Make connections and terminations electrically and mechanically secure. Sizes of connectors to be as per manufacturer's recommendations for various sizes and combinations of wire sizes.  |
|   | .2 | Make joints required in branch wiring #8 and smaller "twist-on" type connectors as manufactured by "Ideal" (colour coded wirenut) or "Marrettes" #31, #33 or #35, or approved equivalents.   |
|   | .3 | Make joints for all other wiring utilizing "Thomas & Betts" colour keyed compression type connectors #5400 series (two hole, long barrel) complete with TBM series compression tools. A first layer of compound type tape to be followed by an additional layer of "Scotch" #33 vinyl tape. Bolt compression connectors together and torqued in accordance with manufacturer's recommendation. |
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3.1 WIRE AND BOX .4 Marrette type connectors to be plier tightened.

CONNECTORS  
INSTALLATION  
(Cont'd)

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PART 1 - GENERAL

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| <u>1.1 REFERENCES</u>                     | .1 | CSA C22.2 No. 0.3-2009, Test Methods for Electrical Wires and Cables.                              |
|   | .2 | CSA C22.2 No. 208-03 (R2008), Fire Alarm and Signal Cable.   |
| <u>1.2 RELATED WORK</u>                   | .1 | Electrical General Requirements: Section 26 05 00  |
| <u>1.3 PRODUCT DATA</u>                   | .1 | Submit product data in accordance with Section 01 33 00.   |
| <u>1.4 OPERATION AND MAINTENANCE DATA</u> | .1 | Submit operation and maintenance data for incorporation into manual specified in Section 01 33 00. |

PART 2 - PRODUCTS

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| <u>2.1 WIRES</u> | .1 | Conductors: to be copper; stranded for 8 AWG and larger. Minimum size: 12 AWG.   |
|                  | .2 | Copper conductors sized as indicated or as required by C.E.C., with 600 V (208V systems) or 1000V (600V systems) insulation of chemically cross-linked thermosetting polyethylene material rated RW90 or as required by C.E.C. |
|                  | .3 | Grounding and bonding conductors are to have green coloured RW90 cross linked insulation.  |
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PART 3 - EXECUTION

3.1 INSTALLATION OF .1      Wires to be installed in conduit. Provide a separate  
BUILDING WIRES           bonding conductor in all conduit runs.

PART 1 - GENERAL

- 1.1 REFERENCES .1 ANSI/IEEE 837-2002, Qualifying Permanent Connections  
Used in Substation Grounding.

PART 2 - PRODUCTS

- 2.1 EQUIPMENT .1 Grounding conductors: bare stranded copper,  
un-tinned soft annealed, size as indicated.
- .2 Insulated grounding conductors: green, type RW90.
- .3 Non-corroding accessories necessary for grounding  
system, type, size, material as indicated, including  
but not necessarily limited to:
- .1 Grounding and bonding bushings.
- .2 Protective type clamps.
- .3 Bolted type conductor connectors.
- .4 Thermit welded type conductor connectors.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

PART 3 - EXECUTION

- 3.1 INSTALLATION .1 Install complete permanent, continuous grounding  
GENERAL system including, electrodes, conductors, connectors,  
accessories to conform to requirements of the  
Contract documents and local authority having  
jurisdiction.
- .2 Install connectors in accordance with manufacturer's  
instructions.
- .3 Protect exposed grounding conductors from mechanical  
injury.
- .4 Make buried connections, and connections to  
electrodes, using exothermic welding or inspectable  
wrought copper compression connectors to ANSI/IEEE  
837.
- .5 Soldered joints not permitted.
- .6 Use mechanical connectors for grounding connections  
to equipment provided with grounding lugs.

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| 3.1 INSTALLATION<br>GENERAL<br>(Cont'd) | .7 | Install separate ground conductor to outdoor lighting standards.  |
|   | .8 | Provide insulated copper bonding conductor in all conduit runs.   |
| 3.2 ELECTRODES                          | .1 | Bare copper conductor used as a ground electrode shall be encased in the tower concrete foundation footing.   |
|   | .2 | Use copper conductors, sized as indicated on the drawings.  |
|   | .3 | Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.   |
| 3.3 SYSTEM AND<br>CIRCUIT GROUNDING     | .1 | Install system and circuit grounding connections to neutral of secondary systems.   |
| 3.4 EQUIPMENT<br>GROUNDING              | .1 | Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, control panels, distribution panels and outdoor lighting. |
| 3.5 FIELD QUALITY<br>CONTROL            | .1 | Perform tests in accordance with Section 26 05 00- Electrical General Requirements.   |
|   | .2 | Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.                  |
|   | .3 | Perform tests before energizing electrical system.  |

PART 1 - GENERAL

Not applicable.

PART 2 - PRODUCT

2.1 FASTENINGS

- .1 All fastenings and supports shall be 316 stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Secure equipment to poured concrete with expandable inserts.
- .2 Fasten exposed conduit or cables using straps.  
.1 One-hole straps to secure surface conduits and cables 50 mm and smaller.  
.2 Two-hole steel straps for conduits and cables larger than 50 mm.  
.3 Beam clamps to secure conduit and cable to exposed steel work.
- .3 For surface mounting of two (2) or more conduits, use channels spaced in accordance with the Canadian Electrical Code (maximum 1.5 m spacing).
- .4 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .5 Confirm there is adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .6 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .7 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.
- .8 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.
- .9 In addition to C.E.C. minimum conduit spacing requirements, all suspended conduit runs containing horizontal or vertical elbows are to have one

3.1 INSTALLATION  
(Cont'd)

- .9 (Cont'd)  
additional support rod installed not greater than 300 mm and mid point of "all" 90° bends. Maximum spacings between conduit support channels shall be as dictated by smallest size conduit(s) being supported and/or secured to same.
- .10 Where galvanized steel supports are exposed to moisture, touch-up all field cut surfaces with galvanizing paint.
- .11 Provide isolator pads between dissimilar metals as required.





PART 1 - GENERAL

- 1.1 REFERENCES .1 CSA C22.1-2012 Canadian Electrical Code, Part 1.

PART 2 - PRODUCTS

- 2.1 OUTLET AND CONDUIT BOXES GENERAL
- .1 Size boxes in accordance with CSA C22.1.
- .2 102 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.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.
- 2.2 FITTINGS-GENERAL
- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes. Use watertight locknuts for all cable/conduit terminations in process control cabinets and NEMA 4X junction/pull boxes.
- .5 All mounting hardware to be stainless steel.
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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 and armoured cable connections. Reducing washers are not allowed.

## PART 1 - GENERAL

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| <u>1.1 LOCATION OF CONDUIT</u> | .1 | Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.                             |
| <u>1.2 REFERENCES</u>          | .1 | C22.2 NO. 45.1-07, Electrical Rigid Metal Conduit - Steel (Tri-National standard, with UL 6 and NMX-J-534-ANCE-2007). |
|                                | .2 | CSA C22.2 No. 211.2-2011, Rigid PVC (Unplasticized) Conduit.  |

## PART 2 - PRODUCTS

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| <u>2.1 CONDUITS</u>           | .1 | Hot dipped, rigid galvanized steel threaded conduit to CSA C22.2 No. 45.1.  |
|                               | .2 | Rigid PVC conduit to CSA C22.2 No. 211.2.   |
|                               | .3 | EMT may only be used inside the cabinet.  |
| <u>2.2 CONDUIT FASTENINGS</u> | .1 | One hole conduit straps to secure surface conduits 50 mm and smaller. Two (2) hole conduit straps for conduits larger than 50 mm.   |
|                               | .2 | Pipe clamps to secure conduits to support channels.   |
|                               | .3 | Refer to specification Section 26 05 29 for suspended and surface support systems for conduits.   |
|                               | .4 | Finishes for conduit fastenings as specified for conduit.<br>.1 In areas where PVC conduit is specified, use PVC coated steel conduit straps.<br>.2 In areas where EMT is permitted, use zinc plated steel materials.<br>.3 In areas where rigid galvanized steel is specified, use galvanized steel materials. |
|                               | .5 | Provide isolators between dis-similar metals as required.   |
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- 2.3 CONDUIT FITTINGS
- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
  - .2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.
- 2.4 EXPANSION FITTINGS FOR RIGID CONDUIT
- .1 Weatherproof expansion fittings with internal bonding assembly suitable for linear expansion as required.
  - .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
  - .3 Weatherproof expansion fittings for linear expansion at entry to building as required.
  - .4 Provide expansion fittings at exit point (above-ground) of all underground services, and where indicated on the drawings.
- 2.5 FISH CORD
- .1 Polypropylene.
- PART 3 - EXECUTION
- 3.1 INSTALLATION
- .1 Use hot dipped rigid galvanized steel threaded conduit except where specified otherwise.
  - .2 Use rigid PVC conduit underground in concrete outdoors where protected from mechanical injury.
  - .3 Use rigid PVC conduit for power, control, instrumentation and general service wiring in slab. Conduit stub ups shall be galvanized steel conduit with heat shrink sleeve. EMT is not permitted in concrete slab.
  - .4 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
  - .5 Mechanically bend steel conduit over 19 mm dia.
  - .6 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
  - .7 Install fish cord in empty conduits.
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- 3.1 INSTALLATION  
(Cont'd)
- .8 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.
  - .9 Dry conduits out before installing wire.
  - .10 Minimum conduit size: 21 mm diameter.
  - .11 Provide minimum 300 mm spacing between instrumentation/control conduits and power conduits. Where possible, instrumentation/control conduits to cross at right angles to power conduits.
  - .12 Where rigid galvanized steel conduit is exposed to moisture, touch up all threaded connections and damaged areas with galvanizing paint.
  - .13 Prior to installing conduits on the overhead ramp structure, coordinate conduit routing with structural contractor to ensure required vertical clearances are maintained.
- 3.2 CONDUITS IN  
CAST-IN-PLACE  
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 Install sleeves where conduits pass through slab or wall.
  - .4 Where conduits pass through waterproof membrane, provide oversized sleeve before membrane is installed. Use cold mastic between sleeve and conduit.
  - .5 Do not place conduits in slabs in which slab thickness is less than four (4) times conduit diameter.
  - .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
  - .7 Organize conduits in slab to minimize cross-overs.
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3.3	CONDUITS IN CAST-IN-PLACE SLABS ON GRADE	.1	Run conduits 25 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.
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3.4	CONDUITS UNDERGROUND	.1	Slope conduits to provide drainage.
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PART 1 - GENERAL

Not applicable.

PART 2 - PRODUCTS

Not applicable.

PART 3 - EXECUTION

3.1 CABLE  
INSTALLATION IN  
DUCTS

- .1 Install cables as indicated in ducts.
- .2 Do not pull spliced cables inside ducts.
- .3 Install multiple cables in duct simultaneously.
- .4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .6 Before pulling cable into ducts and until cables properly terminated, seal ends of non-leaded cables with moisture seal tape.
- .7 After installation of cables, seal duct ends with duct sealing compound.

3.2 FIELD QUALITY  
CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Electrical General Requirements.
  - .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
  - .3 Check phase rotation and identify each phase conductor of each feeder.
  - .4 Check each new and existing feeder for continuity, short circuits and grounds. Confirm resistance to ground of circuits is not less than 50 megohms.
  - .5 Tests:
    - .1 After installing cable but before terminating, perform insulation resistance test with 1000 V megger on each phase conductor for 600 V circuits and 500 V megger on each phase conductor for 120/208 V circuits.
    - .2 Check insulation resistance after each termination to ensure that cable system is ready for acceptance testing.
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- 3.2 FIELD QUALITY CONTROL  
(Cont'd)
- .6 Perform insulation resistance testing on all existing feeders prior to reuse.
  - .7 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.
  - .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.



PART 1 - GENERAL

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

1.2 REFERENCES .1 CAN/CSA C802.2-06(R2011), Minimum Efficiency Values for Dry Type Transformers.

PART 2 - PRODUCTS

2.1 TRANSFORMERS .1 Use transformers of one (1) manufacturer throughout project.

.2 Transformers to meet or exceed energy efficiencies as outlined in CAN/CSA C802.2.

.3 Design 1:

- .1 Type: Dry, epoxy-potted (ANN).
- .2 Single phase, kVA as indicated, 600 V input, as indicated V output, 60 Hz.
- .3 Voltage taps: standard.
- .4 Insulation: Class H, 150°C temperature rise.
- .5 Basic Impulse Level (BIL): standard
- .6 Hipot: standard
- .7 Average sound level: standard
- .8 Impedance at 170°C: standard
- .9 Enclosure: EEMAC 4X.
- .10 Mounting: wall
- .11 Finish: in accordance with Section 26 05 00- Electrical General Requirements.

2.2 EQUIPMENT IDENTIFICATION .1 Provide equipment identification in accordance with Section 26 05 00- Electrical General Requirements.

.2 Label size: 7.

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PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Mount transformers as shown on the Project Drawings.
  - .2 Install with 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 Make primary and secondary connections in accordance with wiring diagram.
  - .6 Energize transformers after installation and testing is complete.
  - .7 Megger both primary and secondary windings with 1000 V and 500 V megger and report any reading below 100 mega ohms.

## PART 1 - GENERAL

- 1.1 SHOP DRAWINGS
- .1 Submit shop drawings in accordance with Section 01 33 00.
  - .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

## PART 2 - PRODUCTS

- 2.1 PANELBOARDS
- .1 Panelboards: product of one manufacturer.
    - .1 Install circuit breakers in panelboards before shipment.
  - .2 600 V and 250 V Panel boards: Bus and breakers rated for interrupting capacity. (RMS Symmetrical) as indicated on the drawings.
  - .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
  - .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
  - .5 Tin-plated copper bus with neutral of same ampere rating as mains.
  - .6 Mains: suitable for bolt-on breakers.
  - .7 Trim and door finish: baked grey enamel.
  - .8 Panelboards shall be of the loadcentre type, complete with bolt-on circuit breakers.
- 2.2 BREAKERS
- .1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.
  - .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
  - .3 Breakers installed in existing panelboards shall be compatible with same.
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- 2.3 EQUIPMENT IDENTIFICATION
- .1 Provide equipment identification in accordance with Section 26 05 00 - Electrical General Requirements.
  - .2 Nameplate for each panelboard size 9 engraved as indicated.
  - .3 Complete circuit directory with typewritten legend showing location and load of each circuit.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
  - .2 Connect loads to circuits.
  - .3 Connect neutral conductors to common neutral bus with respective neutral identified.

PART 1 - GENERAL

- 1.1 SHOP DRAWINGS AND PRODUCT DATA .1 Submit shop drawings and product data in accordance with Section 01 33 00.

PART 2 - PRODUCTS

- 2.1 RECEPTACLES .1 Heavy duty, specification grade duplex receptacles, CSA type 5-15B, 125 V, 15 A, U-ground, yellow colour.  
.1 Suitable for wet locations. IP66 or greater.
- .2 Other receptacles with ampacity and voltage as indicated.
- .3 Receptacles of one (1) manufacturer throughout project.

- 2.2 COVER PLATES .1 Cover plates for wiring devices.
- .2 Cover plates from one (1) manufacturer throughout project.
- .3 Self-closing, weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets and stainless steel hardware.

PART 3 - EXECUTION

- 3.1 INSTALLATION .1 Receptacles:  
.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
- .2 Cover plates:  
.1 Do not use cover plates meant for flush boxes.

## PART 1 - GENERAL

- 1.1 PRODUCT DATA
- .1 Submit product data in accordance with Section 01 33 00.
  - .2 Include time-current characteristic curves for breakers with ampacity of 60 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

## PART 2 - PRODUCTS

- 2.1 BREAKERS GENERAL
- .1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
  - .2 Common-trip breakers: with single handle for multi-pole applications.
  - .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 5-10 times current rating.
  - .4 Circuit breakers to have interrupting rating (momentary RMS symmetrical) as indicated.
- 2.2 THERMAL MAGNETIC BREAKERS
- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
  - .2 Provide marked ground fault interrupter type for circuits.
- 2.3 MAGNETIC BREAKERS
- .1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.
-

- 2.4 OPTIONS
- .1 Provide enclosures for individual circuit breakers as indicated on the Drawings. Unless noted otherwise, enclosure shall be NEMA 3R.
  - .2 Provide service entrance rated enclosed circuit breaker where indicated on the Drawings.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Install in circuit breakers as indicated.

## PART 1 - GENERAL

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| <u>1.1 RELATED SECTIONS</u> | .1 | High Mast Protective Coatings: Section 09 91 13  |
|                             | .2 | Low Intensity (L.I.) Red Obstruction Lighting: Section 26 55 36  |
| <u>1.2 REFERENCES</u>       | .1 | AASHTO specification for "Structural Supports for Highway Signs, Luminaires and Traffic Signals".                          |
|                             | .2 | CAN/CSA-A3000-08, Cementitious Materials Compendium  |
|                             | .3 | ASTM A572-2012, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.                    |
|                             | .4 | ASTM A595-2011, Standard Specification for Steel Tubes, Low-Carbon or High-Strength Low-Alloy, Tapered for Structural Use. |
|                             | .5 | ASTM A36-08, Standard Specification for Carbon Structural Steel.   |
|                             | .6 | ASTM A123-12, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.                    |

## PART 2 - PRODUCTS

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|----------------------------|----|--|
| <u>2.1 HIGH MAST POLES</u> | .1 | Poles: to AASHTO specification designed for underground wiring and:<br>.1 Mounting on concrete anchor base.<br>.2 Suitable for minimum five (5) floodlight luminaires as indicated on the drawings.<br>.3 Pole length: 15.24 m nominal.<br>.4 Style - single section shaft, properly sized hand hole, anchor base, tenon and anchor bolts.<br>.5 Shaft to consist of tapered round or multi-sided steel tube.<br>.6 No field welding will be permitted in the assembly of the pole.<br>.7 The steel material used for the pole sections and base plate shall meet the requirements of ASTM A572 or ASTM A595 Grade A as required for wind loading. |
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2.1 HIGH MAST POLES (Cont'd)	.1	Poles:(Cont'd) .8 Material to be single ply sheet, formed into a tubular shape with longitudinal welds. No circumferential welds are permitted. .9 The pole top tenon to be 100mm diameter by 150mm height and integrally welded to the pole. .10 The base plate to be integrally welded to the pole shaft with either a telescoping type joint with circumferential weld top and bottom or a full penetration butt weld with backup bar. .11 Hand hole to be peripherally reinforced with flat steel bar integrally welded to the pole shaft. The hand hole to be a nominally 102 mm wide by 178 mm high opening to allow for installing, maintaining and servicing the lowering device and lighting control equipment. .12 Supply hand hole with a gasketted, hinged cover, secured to the hand hole reinforcement with stainless steel fasteners. No internal reinforcement which could trap acid in a galvanizing process will be permitted. Weld a grounding point inside the pole adjacent to the hand hole opening for grounding purposes. .13 Galvanize complete pole in accordance with the requirements of ASTM A123. Perform welding by CWB (Canadian Welding Bureau) certified welders and make all welds such that they comply with most recent requirements of the CWB Structural Welding Code. .14 Refer to Section 09 91 13 for protective surface finishes. .15 Provide ten (10) year warranty against rust. .16 Rated for 160.9 km/hr (100 mph) wind loads with 1.3 gust factor and EPA rating of luminaires mounted on the pole plus 25% contingency. .17 Acceptable Products: .1 Valmont DS210 Series. .2 Dynapole TRS Series. .3 Thomas and Betts, All-Struct
2.2 LEVELLING GROUT	.1	To CSA A3000, product as recommended by pole manufacturer.
2.3 LUMINAIRES	.1	Type M1: .1 One-piece die cast aluminum housing. .2 Copper wound ballast 90% power factor. .3 Ballast components removable with quick disconnect assembly. .4 Terminal block provided for wiring connections. .5 Protected starter to sense lamp failure. .6 Inner visor to control glare.

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2.3 LUMINAIRES  
(Cont'd)

- .1 Type M1:(Cont'd)
  - .7 347V; 1000 W pulse start MH lamp.
  - .8 Warranty: five (5) years.
  - .9 Electrostatically applied, thermally cured textured powder coat paint. Aluminum colour.
  - .10 Acceptable material:
    - .1 Lithonia 170S series
    - .2 Keene AKTRA II series
    - .3 Phoenix IC Series

2.4 LIGHTING  
CONTACTOR

- .1 Two-pole, 600V, 30A, electrically-held type.
- .2 Control voltage to be 120VAC.
- .3 Enclosure: NEMA 4, steel construction.
- .4 Acceptable products:
  - .1 Allen-Bradley 500FL series.
  - .2 Schneider LS series
  - .3 Siemens LE series.

2.5 TIMECLOCK

- .1 Mount timeclock in control cabinet.
- .2 Timeclock to have 24 hour/7 day single channel functionality.
- .3 Timeclock to be electronic with digital display.
- .4 Contacts must be suitable for 120 V AC 10A minimum.
- .5 Acceptable equipment: Intermatic FM1D 20A or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install the lighting system as per the manufacturers recommendations.
- .2 Install poles plumb.
- .3 Confirm with Departmental Representative all luminaries are properly aimed and aligned.
- .4 Ground pole to a dedicated ground electrode. Bond ground electrode to circuit bond conductor.

- 3.1 INSTALLATION  
(Cont'd)
- .5 Connect electrical components to luminaires utilizing manufacturer's supplied wiring harnesses.
  - .6 Connect 347/600 V, 3 phase, 4 wire circuits to equipment at pole base.
  - .7 Measure phase currents with lighting operating at maximum.
  - .8 Follow all manufacturers instructions for proper lifting of light poles.