PART 1 - GENERAL

1.1 GENERAL

.1 N/A

1.2 CODES AND STANDARDS

.1 Do complete installation in accordance with 2012 Canadian electrical code, part I (22nd edition), safety standard for electrical installations, Includes Update No. 1,except where specified otherwise.

.2 General Requirements - Ontario Electrical Code, Part II in accordance with CAN/CSA-C22.2 No. 0M91 (R2009).

.3 Do overhead and underground systems in accordance with CSA C22.3 No.1-2010 except where specified otherwise.

1.3 PERMITS, FEES AND INSPECTION

.1 Contractor will submit an application for inspection with the Electrical Safety Authority as required under Section 2 - General Rules Administrative Item 2-004 of the Ontario Electrical Safety Code and shall pay all fees for said permit applications.

.2 Furnish Certificates of Acceptance from the Electrical Safety Authority on completion of work to the Departmental Representative.

1.4 MATERIALS AND EQUIPMENT

.1 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 Electrical Inspection Department.

.2 Factory assemble control panels and component assemblies.

1.5 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
.1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1-1955.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.1 Nameplates:

.1 Lamicoid 3 mm thick plastic engraving sheet, white face, black core, mechanically attached with self tapping screws.

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	6 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Wording on nameplates to be approved by the Departmental Representative prior to manufacture.

.3 Allow for average of twenty-five (25) letters per nameplate.

.4 Identification to be English and French.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Terminal cabinets and pull boxes: indicate system and voltage.

1.7 WIRING IDENTIFICATION

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

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

1.8 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxilliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Communication Systems	Red	

1.9 WIRING TERMINATIONS

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

1.10 MANUFACTURERS AND CSA LABELS

.1 Visible and legible, after equipment is installed.

1.11 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.

1.12 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

.2 The work of this division to be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province that the work is being constructed.

.3 Insulation resistance testing.
.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
.3 Check resistance to ground before energizing.

.4 Carry out tests in presence of the Departmental Representative.

.5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.6 Submit test results for the Departmental Representative's review.

PART 2 - PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 - EXECUTION

3.1 Not Used. .1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA C22.2. No.65-2013 Wire Connectors.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Pressure type wire connectors: with current carrying parts of copper alloy sized to fit copper conductors as required.

.2 Fixture type twist on splicing connectors: with current carrying parts of copper alloy sized to fit copper conductors 10 AWG or less.

.3 Clamps or connectors for armoured cable, flexible conduit, metallic sheathed cable as required.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No. 65.

.3 Install fixture type twist on connectors and tighten.

.4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 26 05 20 - Wire and Box Connectors - 1000V.

.2 Specialty wiring and installation methods will be specified in the related section.

1.2 REFERENCES

.1 CSA C22.2 No. 0.3-2009, Test Methods for Electrical Wires and Cables.

.2 ULC-S139-2012, Standard Method of Fire Test for Evaluation of Integrity of Electrical Power, Data, and Optical Fibre Cables.

1.3 PRODUCT DATA

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

PART 2 - PRODUCTS

2.1 BUILDING WIRES

.1 Conductors: stranded for 10AWG and larger. Minimum size: 12AWG.

.2 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RWU90 insulation.

PART 3 - EXECUTION

3.1 INSTALLATION OF BUILDING WIRES

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

END OF SECTION

PART 1 - GENERAL

1.1 PRODUCT DATA .1 Submit any available product data for information purposes in accordance with Section 01 33 00 - Submittal Procedures.

PART 2 - PRODUCTS

2.1 CONNECTORS AND TERMINATIONS (REFER .1 Copper/ Aluminum long barrel compression connectors as required sized for conductors.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

.1 Fastenings and supports: Section 26 05 00 - Common Work Results - Electrical.

PART 2 - PRODUCTS

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Secure equipment to poured concrete with expandable inserts.

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

.3 Fasten exposed conduit or cables to building construction or support system using straps.
.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
.2 Two-hole steel straps for conduits and cables larger than 50 mm.
.3 Beam clamps to secure conduit to exposed steel work.

.4 Suspended support systems.
.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.5 For surface mounting of two or more conduits use channels at 3 m oc spacing or as indicated.

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

3.1 INSTALLATION (Cont'd)

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

END OF SECTION

PART 1 - GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

PART 2 - PRODUCTS

2.1 JUNCTION AND PULL BOXES

.1 PVC boxes suitable for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes. Covers to be gasketed.

.3 Minimum size of junction and pull boxes is 150 x 150 x 100 mm.

PART 3 - EXECUTION

3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Install pull boxes so as not to exceed 30 m of conduit Only main junction and pull boxes are indicated. run between pull boxes and maximum of 2 - 90 degree bends.

3.2 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase for boxes 305 x 305 x 100 mm and larger.

.3 Provide P-Touch identification for all smaller boxes.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA C22.1-2012 Ontario Electrical Safety Code.

PART 2 - PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1-09.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

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.

.5 Plastic pre-formed vapour barrier boxes to be used for all boxes mounted in exterior outside walls for boxes that penetrate the vapour barrier.

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.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA).
.1 CSA C22.2 No.18.2-06(R2011)Non metallic Outlet Boxes
.2 CSA C22.2 No.56-04(R2009), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
.3 CSA C22.2 No 211.2-06(R2011) Conduit, Update No. 1
.4 CSA C22.2 No 85-M89 (R2010) Rigid PVC Boxes and Fittings.

PART 2 - PRODUCTS

2.1 CONDUITS

.1 EB1 PVC conduit: to CSA C22.2-211.2, with connectors and couplings.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1 m oc.

.4 Threaded rods, 6 mm dia., to support suspended channels.

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 FISH CORD

.1 6mm Polypropylene.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Use EB1 PVC conduits in exposed wet locations and for underground direct buried applications. Use the recommended couplings and fittings on all EB1 PVC conduits and use the cleaners and contact cement specifically designed for use with EB1 PVC Conduit.

3.1 INSTALLATION (Cont'd)

.2 Install fish cord in all empty conduits.

.3 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.4 Dry conduits out before installing wire.

3.2 SURFACE CONDUITS

.1 Conduits to have long sweeping bends.

.2 Group conduits wherever possible on suspended and surface channels.

.3 Do not pass conduits through structural members except as indicated.

3.3 CONCEALED CONDUITS

.1 Do not install horizontal runs in masonry walls.

.2 Conduits to be installed in the poured concrete floor slab will be reviewed with the structural engineer prior to installation. Install conduits in the centre of the slab as directed by the structural engineer. Tie conduits to the reinforcing steel with tie wire.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 31 23 33.01 - Excavating, Trenching and Back-filling.

.2 Section 26 05 00 - Common Work Results - Electrical.

PART 2 - PRODUCTS

2.1 PULLING LUBRICANT

.1 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension. Contractor to submit WHMIS documents for all lubricants used.

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 are properly terminated, seal ends of cables with moisture seal tape.

.7 After installation of cables, seal duct ends with duct sealing compound.

3.2 MARKERS

.1 Mark cable every 15 m along duct runs and changes in direction.

.2 Mark underground splices.

3.3 FIELD QUALITY - CONTROL

.1 Perform tests in accordance with Section 26 05 00 Common Work Results - Electrical.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

3.3 FIELD QUALITY - CONTROL (Cont'd)

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance tests:
.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each secondary phase conductor.
.2 Check insulation resistance after each termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests:
.1 Ensure that terminations and accessory equipment are disconnected.
.2 Ground shields, ground wires, metallic armour and conductors not under test.
.3 High Potential (Hipot) Testing. Conduct hipot testing at 90% of original factory test voltage in accordance with IPCEA recommendations.
.4 Leakage Current Testing:
.1 Raise voltage in steps from zero to maximum values as specified by IPCEA for type of cable being tested.
.2 Hold maximum voltage for specified time period by IPCEA.
.3 Record leakage current at each step.

.7 Provide the Department 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.

END OF SECTION