



Collus PowerStream

General Contractor
Requirements and Material
Specifications for
Municipal Subdivision

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1.0 Contractor Approval

1. Collus PowerStream shall have the right to require the Contractor to submit proof of previous experience, and employee qualifications. Also Collus PowerStream shall have the right to investigate such proof prior to the Owner awarding a contract for the work to the Contractor.

2.0 Inspection

1. Collus PowerStream will provide an Inspector at the expense of the Developer who will be on duty for the duration of the work, and the Contractor shall supply him such accommodations as required. The Inspector shall have the authority to stop work at any time he feels the Contractor is not proceeding in accordance with Collus PowerStream requirements.
2. Prior to any installation the entire site must be prepared to within six (6") inches of final grade. There will be no exceptions made to this requirement. Also a pre-Construction meeting must be held prior to starting the project with the Contractor's foreman and inspector present along with any other key personnel.
3. Before commencing installation, the Developer or Contractor shall notify Collus PowerStream the requirement for an Inspector. Notice shall be submitted at least seventy-two (72) hours prior to the commencement of work.
4. Any work done in the absence of an Inspector will be ordered to be opened up for examination and should there be any faults in the workmanship or materials, must be rebuilt or replaced as directed by the Inspector at the Contractor's sole expense, but no approval by any Inspector shall be taken as or construed into acceptance of defective or improper work or material, which in every case must be removed and properly replaced whenever discovered at any stage of the work.
5. The Inspector's responsibilities do not include ensuring the trench is in accordance with the Trench Excavators Act or the Construction Safety Act, nor shall the Inspector set out work, or give any stakes, lines, levels or grades.

3.0 Inspection Costs

1. Current Inspections Rate as of July 1, 2014
2. Chargeable Labour Rate = \$ 80.00/hr + Taxes (During Regular Business Hours)
3. Chargeable Equipment Rate (Vehicle) = \$55.00 / hr. + Taxes

4.0 Cable Termination & Testing

1. Collus PowerStream may complete ALL cable terminations and high voltage testing at the expense of the Developer.
2. All required materials to be supplied by the Developer, and must be new (unused) Materials which meet Collus PowerStream's requirements and standards.

5.0 Material Specifications

1. All materials must be accompanied by a letter of compliance with regard to Section 6 of Ontario Regulation 22/04 (ESA).
2. Transformers must be accompanied by a report the design meets CAN/CSA- C227.3-M91 standard
3. All reports and certifications pertaining to all materials must be supplied to Collus PowerStream for verification prior to any installation
4. This section includes a listing of the main distribution materials used in Municipal Subdivisions. For confirmation of all other materials, please contact Collus PowerStream

5.1 Secondary Cables

1. Scope: This specification covers the construction of 600 Volt triplex secondary cables for underground distribution systems. This cable will be utilized to provide up to a maximum of 200 amps at 120/240 volt service, from the transformer to the customer's service meter.
2. All components described in this specification are to conform to CAN/CSA C22.2 No.52 latest issue, unless otherwise noted. Cables to comply with CSA USEI90 class designation.
3. Conductors: The conductors including 100% rated neutral conductor, is to be minimum #4/0AWG Class "B" stranded compact aluminum. Conductors must be sized for the
4. Insulation: Insulation is to be cross-linked polyethylene (XLPE), 90oC in wet, damp and dry locations. The insulation shall be suitable for use at maximum operation temperature of 90oC continuous, 130oC emergency loading and 250oC for short circuit conditions.
5. Jacket: The insulation jacket shall be PVC. The neutral conductor jacket shall be identified by a white PVC jacket. At least one phase conductor will show the words "600 Volt Underground Cable" printed at intervals not exceeding 1000mm. The cable must be indelibly identified in accordance with the requirements of CSA standard C22.2 No.52.
6. Splices: Splices in secondary cable not accepted unless prior approval from Collus PowerStream Engineering Department.
7. Cable Marking Identification: Collus PowerStream will do all cable tagging at the developer's expense. (Included in cable termination & testing price).

5.2 Primary Cables – Main Express Feeders (3-Phase)

1. Scope: The specification covers the construction of 15 kV jacketed concentric neutral cable for installation in ducts of 3-phase main express feeders. The cable will be utilized to provide 600 Amp, 3 phase, 2400/4160V multi-grounded services.

2. All components described in this specification are to conform to and certified in accordance with CAN/CSA C68.3 (latest issue) unless otherwise approved by Collus.
3. Conductor: The conductor is to be 500MCM compressed round uncoated annealed copper class "B" stranded
4. Conductor Shield: Conductor shield to consist of extruded semi-conducting cross- linked polyolefin.
5. Insulation: The insulation shall be tree-retardant cross-linked polyethylene TR-XLPE. Insulation thickness to 15kV, 100% insulation level. The insulation shall be suitable for use at a maximum operation temperature of 90oC continuous, 130oC emergency loading and 250oC for short circuit conditions.
6. Insulation Shield: Insulation shield shall consist of extruded semi-conducting polyethylene, thickness as per CSA standards. The covering shall strip freely from the insulation and when removed shall not leave conducting particles, threads, or residue on the surface of the insulation.
7. The semi-conducting insulation shield shall be printed at regular intervals not exceeding 1000mm the following instruction:
 - a. The words "Remove when Terminating or Splicing"
 - b. Name of manufacturer
 - c. Description of cable construction
8. Concentric Shield: The concentric neutral to consist of helically applied, annealed uncoated copper round wire conductors to provide 33% conductivity.
9. Outer Jacket: to consist of non-conducting, linear low-density polyethylene (LLDPE), extruded to fill spaces between neutral wires, moisture-resistant, black, sunlight resistant rated for -40°C.
10. Cable marking on the outer jacket shall be legibly and indelibly printed at regular intervals as follows:
 - a. Name of manufacturer
 - b. Year of manufacturer

- c. Conductor description, noting neutral capacity and temperature rating.
- d. Sequential meter marking as per CSA C68.3 Standard

11. Splicing: Splices in primary cable are NOT accepted.

5.3 Primary Cables – Local Feeders (Single Phase)

1. Scope: This specification covers the construction of 15 kV, jacketed concentric neutral cable for installation in individual ducts of single phase local on loop feeders. The cable will be utilized to provide single phase 200 Amp service from a three phase 2400/4160 V, multi-grounded distribution system.
2. All components described in this specification are to conform to CAN/CSA C68.3-97 latest issue, unless otherwise noted.
3. Conductors: The conductor shall be 1/0 (AWG) or 3/0 (AWG) compressed uncoated annealed copper class "B" stranded.
4. Conductor Shield: Conductor shield to consist of extruded semi-conducting cross- linked polyolefin.
5. Insulation: The insulation shall be tree-retardant cross-linked polyethylene TR XLPE. Insulation thickness to 15kV, 100% insulation level.
6. Insulation Shield: Insulation shield shall consist of extruded semi-conducting polyethylene, thickness as per CSA standards. The covering shall strip freely from the insulation and when removed shall not leave conducting particles, threads, or residue on the surface of the insulation.
7. The semi-conducting insulation shield shall be printed at regular intervals not exceeding 1000mm the following instruction:
 - a. The words "Remove when Terminating or Splicing"
 - b. Name of manufacturer
 - c. Description of cable construction

8. Concentric Shield: The concentric neutral to consist of helically applied, annealed uncoated copper round wire conductors to provide 100% conductivity.
9. Outer Jacket: to consist of non-conducting, linear low-density polyethylene (LLDPE), extruded to fill spaces between neutral wires, moisture-resistant, black, sunlight resistant rated for -40oC.
10. Cable marking on the outer jacket shall be legibly and indelibly printed at regular intervals as follows:
 - a. Name of manufacturer
 - b. Year of manufacturer
 - c. Conductor description, noting neutral capacity and temperature rating.
 - d. Sequential meter marking as per CSA C68.3 Standard
11. Splicing: Splices in primary cable are NOT accepted.

5.4 Conduit Specifications for Primary & Secondary Cables

1. Conforms to CAN/CSA C211.1-M1984, latest issue:
2. PVC Duct, Type DB2, suitable for direct burial or concrete encasement
3. Include the following accessories, as required:
 - a. Use PVC solvent compound for all joints.
 - b. PVC couplings, angle fittings, expansion joints, bell end fittings, plugs, caps, adaptors and split ducts as required to make a complete and continuous installation.
4. Primary duct size: 103mm diameter.

5.5 Cable Fault Current Indicators

1. Supply and install current fault indicators on primary cable at each transformer and switching cubicle location.
2. Acceptable manufacturer: H Horstmann GmbH "LT" series underground acoustic FCI model 29-7028-001 (available from Brews Ltd., Mississauga, Ontario).

5.6 Transformers – Single Phase

1. Transformers for residential use shall be supplied by the Owner or Developer and shall be of the low profile mini-pad type built to as per CAN/CSA – C227.3 Standard and Ontario Electrical Safety Code (latest editions)
2. Transformer Characteristics
 - a. kVA rating: 50, 75, 100 or 167 (refer to drawings or single line diagram).
 - b. Minimum Impedance: as per CSA C227.3 Standard (latest edition)
 - c. Transformer losses shall be as per CSA Standard C802.1 (latest edition)
 - d. Polarity: additive
 - e. Primary winding material: Copper
 - f. High Voltage rating for Thornbury and Creemore: 8320GrdY/4800VAC
 - g. High Voltage rating for Collingwood and Stayner: 4160GrdY/2400VAC
 - h. HV BIL rating: 95kV
 - i. HV Insulation Class: 15kV
 - j. HV Tap Changer: 4 – 2.5%, 2 above/2 below (include on nameplate data)
 - k. Secondary winding material: Aluminum
 - l. Low Voltage rating: 240/120V
 - m. LV BIL rating: 30kV
 - n. LV Insulation Class: 1.2kV
 - o. Cooling: ONAN
 - p. Frequency: 60Hz
 - q. Temperature rise by resistance of windings: maximum 65°C above ambient, at rated kVA and voltage. Highest air temperature to be considered is 40°C.
3. Transformer Interference: transformer shall operate without causing interference to radio and TV reception, or telephone communication circuits higher than the limits outlined in CSA Standard C22.4 No.103 standard.
4. Grounding: transformer core shall be electrically connected to the tank. Two grounding busses complete with two 9.5mm holes at each location shall be provided on the transformer tank, one on HV side and one on LV side. Cover on the switching

compartment shall be electrically bonded to the tank with extra- flexible copper braid, as per Ontario Electrical Safety Code.

5. HV and LV bushing requirements:

a. High Voltage (HV):

- i. Two HV Bushing Wells (with removable studs) complete with 200A, 15kV load break inserts, suitable for loop feed system.
- ii. Bleed wires shall be installed on each insert.
- iii. Insulated parking stand for insulated elbow connector shall also be provided between the two bushings as per CSA C227.3 Standard.
- iv. Tilt HV bushing upward for ease of primary cable connection.

a. Low Voltage (LV):

- i. Welded type, and shall be equipped with a plated aluminum bars with seven (7) holes in line, size and spacing as per CSA C227.3.
- ii. Rotate bushing from vertical plane to provide for convenient secondary cable connections.

6. Load break switch: two-position load break switch on primary side.

7. Transformer Protection (Fusing):

a. Provide a two-fuse system as follows:

- i. RTE Bay-O-Net style, oil fuse cut-out with overload sensing and replacement-type elements.
- ii. Back-up Current Limiting fuses (CLF)

a. Include fuse identification on Transformer Nameplate data.

8. Mechanical features:

- a. Equipped with two foundation clamps and recessed lifting provisions.
- b. Sealed tank construction, suitable for oil temperature ranges of minimum -40oC to +105oC.
- c. Transformer must be weatherproof design and tamper resistant in accordance with CSA C227.3 Standard (latest edition), equipped with pentahead bolt c/w cup washer-locking device and free of all sharp corners and edges.
- d. Dome all surfaces facing upwards (tank and cabinet lids) to prevent collection of water.
- e. Cable entry compartment:

- i. Cover to HV and LV sections shall open 180 degrees and be removable.
 - ii. Captive pentahead stainless steel bolts and cup.
 - iii. Corrosion-resistant door hinges (stainless steel).
 - iv. The inside cover or lid of the HV and LV sections shall be coated with a compound to prevent (or deterrent) condensation.
 - v. Electrical bond doors to transformer tank.
 - vi. Removable front cover sill (from transformer tank) and shall include two tamper resistant emergency access holes approximately 65mm in diameter.
 - vii. Provisions for padlocking.
- 9. Transformer Oil: include oil in the transformer to a level which allows for maximum oil expansion. Oil type must be in accordance with CSA standard C50 (latest edition).
- 10. Pressure Relief Device
 - a. Pull-ring style, automatic pressure relief device.
 - b. Opening pressure of pressure relief device must be less than the withstand pressure of tank.
- 11. Finish:
 - a. Tank, sill and cover shall be “shot” or “sand” blasted to remove all rust. Afterwards, apply two coats of rust-resistant primer and two coats of outdoor paint to transformer tank, sill and cable compartment.
 - b. Colour: equipment green (EEMAC Y1-2 equipment green).
 - c. Transformer base shall be coated with an epoxy material.
 - d. The inside cover or lid of the HV and LV sections shall be coated with a compound to prevent (or deterrent) condensation.
 - e. Provide a 100mL container of finish for touch-up and scratches.
- 12. Transformer testing: all standard transformer tests as stated in CSA specification shall be carried out on each transformer. Include copies of the test results in the shop drawing submission.
- 13. Transformer losses: All transformers to be of the low loss design only in accordance with CAN/CSA C802.1 (latest edition) with no exceptions. Copies of the “designed” losses must be included in the shop drawing submission.

14. Acceptable transformer manufacturers: ABB, Cam Tram, Carte, CES and Moloney Electric.

5.7 Transformers – Three phase

1. Transformers for commercial or industrial use shall be supplied by the Owner or Developer and shall be of the pad-mount type built to as per CAN/CSA – C227.4 Standard and Ontario Electrical Safety Code (latest editions)
2. Transformer Characteristics
 - a. kVA rating: up to 300kVA maximum (refer to drawings or single line diagram)
 - b. Minimum Impedance: as per CSA C227.4 Standard (latest edition)
 - c. Transformer losses shall be as per CSA Standard C802.1 (latest edition)
 - d. Primary winding material: Copper
 - e. High Voltage rating for Thornbury and Creemore: 8320GrdY/4800V
 - f. High Voltage rating for Collingwood and Stayner: 4160GrdY/2400V
 - g. HV BIL rating: 95kV
 - h. HV Insulation Class: 15kV
 - i. HV Tap Changer: 4 – 2.5%, 2 above/2 below. Include on nameplate data.
 - j. Secondary winding material: Copper
 - k. Low Voltage rating: 600Y/347 or 208Y/120V (refer to single line diagram)
 - l. LV BIL rating: 30kV
 - m. LV Insulation Class: 1.2kV
 - n. Cooling: ONAN
 - o. Frequency: 60Hz
 - p. Temperature rise by resistance of windings: maximum 65°C above ambient, at rated kVA and voltage. Highest air temperature to be considered is 40°C.
3. Transformer Interference: transformer shall operate without causing interference to radio and TV reception, or telephone communication circuits higher than the limits outlined in CSA Standard C22.4-103.
4. Grounding Requirements:
 - a. Electrically connect transformer core to tank

- b. Provide two spade terminals; one on HV side (marked H0) and one on LV side.
- c. Grounding material: rigid copper bus.
- d. Grounding bracket to facilitate working ground clamps.
- e. Connect low voltage neutral terminal (marked X0) to ground bus.

5. HV and LV Bushings Requirements

- a. High Voltage (HV):
 - i. Six HV Bushing Wells (with removable studs) complete with 200A, 15kV load break inserts, suitable for loop feed system.
 - ii. Bleed wires shall be installed on each insert.
 - iii. Insulated parking stand for insulated elbow connector shall also be provided between the two bushings as per CSA C227.3 Standard.
 - iv. Tilt HV bushing upward for ease of primary cable connection.
- b. Low Voltage (LV):
 - i. Copper plated spade terminal, with standard hole-pattern as per CSA C227.4 Standard.
 - ii. Locate LV bushing in vertical plane, for ease of secondary cable connection.

6. Loadbreak Switch

- a. Provide a 3-phase, 2-position, oil-immersed load break switch, hot stick operable and interlocked.
- b. Continuous rating: 200A
- c. 38kV phase to phase, 150kV BIL
- d. Complies with ANSI C37.72 Standard
- e. Contact speed independent of operator speed
- f. Operating temperature: -40oC to +120oC

7. Transformer Protection (Fusing)

- a. Two fuse system as follows:
 - i. RTE Bay-O-Net style, oil fuse cut-out with overload sensing and replacement-type elements.
 - ii. Back-up Current Limiting fuses (CLF)
- b. Include fuse identification on Transformer Nameplate data.

8. Transformer Oil and Accessories

- a. Deliver transformer filled with oil to a level which allows maximum oil expansion.

- b. Complies with CSA Standard C50, latest edition.
- c. Non-PCB. Include label on transformer.
- d. Provide a drain plug on transformer tank with sampling device.
- e. Include the following indicators (gauges) inside cable entry compartment:
 - i. Oil liquid level.
 - ii. Oil sight glass.
 - iii. Oil temperature.

9. Pressure Relief Device

- a. Pull-ring style, automatic pressure relief device.
- b. Opening pressure of pressure relief device must be less than the withstand pressure of tank.

10. Mechanical Features:

- a. Equipped with two foundation clamps and recessed lifting provisions.
- b. Sealed tank construction, suitable for oil temperature ranges of minimum -40oC to +105oC.
- c. Transformer must be weatherproof design and tamper resistant in accordance with CSA C227.3 Standard (latest edition), equipped with pentahead bolt c/w cup washer-locking device and free of all sharp corners and edges.
- d. Dome all surfaces facing upwards (tank and cabinet lids) to prevent collection of water.
- e. Cable entry compartment:
 - i. Cover to HV and LV sections shall open 180 degrees.
 - ii. Captive pentahead stainless steel bolts and cup.
 - iii. Corrosion-resistant door hinges (stainless steel).
 - iv. The inside cover or lid of the HV and LV sections shall be coated with a compound to prevent (or deterrent) condensation.
 - v. Electrical bond doors to transformer tank.
 - vi. Removable front cover sill (from transformer tank) and shall include two tamper resistant emergency access holes approximately 65mm in diameter.
 - vii. Provisions for padlocking.
 - viii. Flip top compartment lid, with stays.

11. Finish

- a. Tank, sill and cover shall be “shot” or “sand” blasted to remove all rust. Afterwards, apply two coats of rust-resistant primer and two coats of outdoor paint to transformer tank, sill and cable compartment.
- b. Colour: equipment green (EEMAC Y1-2 equipment green).
- c. Transformer base shall be coated with an epoxy material.
- d. The inside cover or lid of the HV and LV sections shall be coated with a compound to prevent (or deterrent) condensation.
- e. Provide a 100mL container of finish for touch-up and scratches.

12. Acceptable Manufacturers: ABB, Cam Tram, Carte and Moloney Electric, CES

5.8 Primary Switching Cubicle (Pad-mounted)

1. Voltage rating: 15kV, 3-phase, 95kV BIL.
2. Enclosure requirements:
 - a. Meets ANSI C57.12.28. Cubicle will be owned and operated by Collus.
 - b. Free-standing, self-supporting structure, suitable for outdoor environments, tamper-resistant to CSA C227.3 standards.
 - c. Corrosion resistant, non-ferrous door hinges and hinge pins.
 - d. Undercoat enclosure roof with an insulating "no-drip" compound.
 - e. Provide a corrosion-resistant finish over entire enclosure, with standard dark green colour to "EEMAC Y1-2 equipment green" standard.
 - f. Include “bus spacer” to increase cable termination height.
 - g. Include a gasket on the enclosure bottom flange for protection from scratches and isolation from concrete foundation.
3. Switching cubicle ratings and arrangement:
 - a. Two 600A-rated external handle-operated switch for 3-pole, gang operated, live switching (line side).
 - b. Two 200A-rated hookstick-operated fusible switch for 1- or 3-pole load circuits.
 - c. Short circuit rating: 14,000A Sym.
 - d. Load circuit fusing mounting type: SML-20, with use of SMU-20 fuse units. Contractor to provide coordination selection of exact fuse type during construction.
 - e. Cycloaliphatic epoxy resin system to insulate all live parts from ground.

- f. Include storage rack for spare fuses and a fuse handling tool (S&C grappler).
 - g. Include one complete set of spare fuses for each switching cubicle.
4. Cable connection requirements:
- a. Provisions for cable entrance and exit through bottom of enclosure.
 - b. Line side switching: provide terminal lugs to accommodate cable size up to one 500MCM stranded copper conductor.
 - c. Fuse side switching: provide terminal lugs to accommodate cable size up to two #4/0AWG stranded copper conductors.
 - d. Cable-terminating device: rod-type compression terminal, tin-plated.
 - e. Provide a ground stud in each switch or fuse compartment.
5. Provide a dual-purpose front "fibreglass-reinforced polyester" barrier for arc and track resistance of each switch and fuse compartment. Include interphase and end barriers, plus additional barriers to separate front and rear compartments.
6. Acceptable manufacturer: S&C Electric (Model PMH-9) and Federal Pacific.

Approved Meter Socket List

NOTE: Collus PowerStream does **NOT** allow the load side lugs of the meter sockets to be used as a splitter. Installations of Meter Socket cabinets, containing auxiliary equipment (i.e. generation transfer switch) are **NOT PERMITTED**.

APPROVED METER SOCKETS 240V/120V			
TYPE	MANUFACTURER		
	THOMAS AND BETTS MICROELECTRIC	EATON CULTER- HAMMER	HYDEL
*200A	BS2-TCV	LM2	EK400RO
400A	JS4B-200/5	TCC5-2	CT4-TSB2/CTS-2TS
**600A OR CENTRAL METERING	CT105	TSU5	CTS-405-PW
TYPE MULTI POSITION	MANUFACTURER		
	THOMAS AND BETTS MICROELECTRIC	EATON CULTER- HAMMER	HYDEL
200A MAIN, 2-POS 100A/POS	N.A	2KN1	SDC220PW
200A MAIN, 2-POS 200A/POS	BDA2-V	2K2	HC22R
400A MAIN, 2-POS 200A/POS	BS42-V	2K4	HC42R

Meter sockets are approved for overhead and underground service both right and left entry is acceptable.

***CRIMP LUGS ARE NOT USED BY COLLUS POWERSTREAM**

****REQUIRES 1 ¼" CONDUIT RUN FOR CURRENT TRANSFORMERS**

APPROVED METER SOCKETS 208/120V, 600/347V & 600V				
Voltage	Service Size	MANUFACTURER		
		THOMAS AND BETTS MICROELECTRIC	EATON CULTER-HAMMER	HYDEL
120/208V NETWORK 2PHASE 3 WIRE 5 JAW	100A	BE1-TCV-5 5JAW AT 9:00 POSITION	K1M 5 JAW AT 9:00 POSITION	SE 400 RW 5 JAW AT 9:00 POSITION
	200A	BS2-TCV-5 5 JAW AT 9:00 POSITION	LM2 5 JAW AT 9:00 POSITION	EK 400 RO 5 JAW AT 9:00 POSITION
120/208V 347/600V 3 PHASE 4 WIRE 7JAW	100A	PL17-IN-TCV	P17-O-IN1	SFC 703 PW
	200A	PL27-IN-TCV	P27-IN2	STC 703 RK
600V DELTA 3 PHASE 3 WIRE 5 JAW	100A	BE1-TCV-6 5 JAW AT 6:00 POSITION	K1M 5 JAW AT 6:00 POSITION	SE 400 RW 5 JAW AT 6:00 POSITION

** Approval by the Collus PowerStream Metering Department is required for all meter sockets, load centers and specialty metering point equipment.