

Part 1 General

1.1 Description

- .1 This section of the Specifications forms part of the Contract Documents and is to be read, interpreted and co-ordinated with all other parts.

Part 2 Products

2.1 Conduits and Fittings

- .1 PVC Conduit
 - .1 To be rigid unplasticized polyvinyl chloride, and to conform to CSA C22.2 No. 211.2. Couplings, adapters, bends, and fittings to be rigid PVC and to conform to CSA C22.2 No. 85. Rigid PVC conduit to be installed using CSA certified cement. Conduit not to be bent in field. Only factory bends acceptable.
 - .2 Each standard length of PVC conduit to bear a CSA certification mark, and all fittings to be CSA certified and so marked.
- .2 HDPE Conduit
 - .1 To meet or exceed ASTM F2160 standards. To be suitable for underground directional bore installation under high traffic roadways.

2.2 Solvent Weld Compound

- .1 Solvent weld compound for PVC duct joints.

2.3 Cable Pulling Equipment

- .1 6 mm stranded nylon pull rope tensile strength 5 kN.

Part 3 Execution

3.1 Installation

- .1 Install duct in accordance with manufacturer's instructions.
- .2 Clean inside of ducts before laying.
- .3 Ensures all conduits is clear of any debris prior to assembly of the conduits.
- .4 Ensure full, even support throughout duct length.
- .5 Slope ducts with 1 to 400 minimum slope.
- .6 During construction, cap ends of ducts to prevent entrance of foreign materials.
- .7 Pull through each duct, wooden mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each duct immediately before pulling-in cables.
- .8 In each duct install pull rope continuous throughout each duct run with 3 m spare rope at each end. A pull rope shall be left in each duct after pulling-in cables to allow for future cables.
- .9 Install markers as required.

Part 1 Products

1.1 Warning Tape

- .1 Detectable by a pipe/cable locator or metal detector from above the undisturbed ground.
- .2 Minimum 50mm wide with an aluminum foil core laminated between two (2) layers of 3.5 mil thickness polyester plastic.
- .3 Plastic colour coding: red for electrical lines, orange for telephone lines.
- .4 A warning shall be imprinted continuously along the length, with message reading similar to: "CAUTION – BURIED ELECTRIC (TELEPHONE) LINE BELOW".
- .5 Typical material: Brady Detectable Identoline, Panduit Detectable Hazard Warning Tape.

Part 2 Execution

2.1 Direct Burial of Cables

- .1 After sand bed specified is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.
- .2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.
- .3 Underground cable splices not acceptable.
- .4 Maintain 75 mm minimum separation between cables of different circuits. Maintain 300 mm horizontal separation between low and high voltage cables. When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position. At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables. Maintain 300 mm minimum lateral and vertical separation for fire alarm and control, cables when crossing other cables, with fire alarm and control cables in upper position. Install treated planks on lower cables 0.6 m in each direction at crossings. All weather wood is not acceptable.

2.2 Field Quality Control

- .1 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .2 Check each cable for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- .3 Pre-acceptance tests
 - .1 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .4 Acceptance tests
 - .1 Ensure that the terminations and accessory equipment are disconnected.
 - .2 Ground shields, ground wires, metallic armour and conductors not under test.
 - .3 Leakage Current Testing
 - .1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.
 - .2 Hold maximum voltage for as specified time period by manufacturer.
 - .3 Record leakage current at each step.

- .5 Provide the City with list of test results showing location at which each test was made, circuit tested and result of each test.
- .6 Remove and replace entire length of cable if cable fails to meet any of test criteria.

Part 1 Products

1.1 Conduits

- .1 Polyvinyl chloride (PVC) conduit: to CSA C22.2 schedule 40.

1.2 Conduit Fastenings

- .1 One hole stainless steel straps to secure surface conduits 50 mm and smaller.
 - .1 Two hole stainless 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 on centre.
- .4 Threaded stainless steel rods, 9 mm diameter, to support suspended channels.

1.3 Conduit Fittings

- .1 Fittings: to CSA C22.2 No. 18.3, No. 18.4, and No. 18.5, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

1.4 Fish Cord

- .1 Polypropylene.

Part 2 Execution

2.1 Conduits Underground

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints.

Part 1 General

1.1 References, Codes, and Standards

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables
 - .2 CSA-C22.2 No. 131, Type TECK 90 Cable

Part 2 Products

2.1 Teck Cable

- .1 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, minimum size #12 AWG or as indicated.
 - .3 Wiring shall be 1000V insulated.
- .2 Armour: interlocking aluminum.
- .3 Inner jacket thermosetting PVC compound.
- .4 Outer jacket of PVC material, rated -40oC and meeting low gas emission and FT 4 flame test requirements set forth in CSA C22.2 - No. 0.3 and IEEE 383.
- .5 Fastenings:
 - .1 One-hole malleable iron straps to secure surface cables 50 mm and smaller. Two-hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two (2) or more cables at 1,500 mm centers.
 - .3 Six (6) mm diameter threaded rods to support suspended channels.
- .6 Connectors:
 - .1 Watertight, approved for TECK cable.

2.2 Fiber Optic Cabeling

- .1 Fibre optic cables shall be indoor/outdoor direct burial rated loose tube, rodent protected and constructed with 24 pair of 50/125/250µm multi-mode glass fibres, spiral interlocked armour, and outer polyethylene jacket. Maximum attenuation shall be 3.5/1.0 dB/km. Minimum modal bandwidth shall be 220 MHz*km

Part 3 Execution

3.1 General

- .1 Install and rate power cables in accordance with the Canadian Electrical Code requirements.

3.2 Testing

- .1 All power and control wiring shall be tested for insulation resistance value with a megger. Resistance values shall be as recommended by the cable manufacturer.
- .2 All wire test results shall be properly tabulated, signed, dated, and submitted to the Contract Administrator.